City of Lynnwood,
Washington

Scriber Lake
Water Quality Assessment and Analysis

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1. Executive Summary

The quality of Scriber Lake was monitored from September to November, 2011, and March to October, 2012. The data during summer 2012 indicate that the lake's trophic state was hypereutrophic based on TP and chl, and nearly so based on transparency. The lake's state in 2012 was essentially the same as it was in 1984- 1985 (Welch and Smayd, 1986). That is despite diversion of about 25% of entering stormwater.

Surprisingly the lake's appearance is not as bad as its trophic state would predict. There are no massive blooms of scum- forming toxic blue-green algae (cyanobacteria) as is nearly always the case in lakes with such high total phosphorus (TP). Instead, the high chl concentrations are mainly due to small-celled, flagellated algae, although one, non-scum forming cyanobacteria did occur in high abundance in late summer. The lake's high water flushing rate (or low water residence time) may be the cause for the dominance of small celled, flagellated algae- as opposed to scum- forming cyanobacteria. While the high inflow of storm water delivers a large TP load, most of that TP is rather quickly transported out of the lake probably has little immediate effect on algae, especially because inflow soluble reactive phosphorus (SRP), the form of P available to algae is relatively low. That is, 100 µg/L of TP and chlorophyll in the lake could not result from an inflow of only 20-30 µg/L SRP. The low-lake TP and SRP concentrations during winter and early spring, during the high inflow flushing period, indicate the low potential for concentration build up that would allow a high algal biomass to develop, and this also reinforces the hypothesis of the impact of TP by the high flushing rate.

The high TP and chl concentrations that occurred during summer and fall probably resulted more from diffusion of SRP from the hypolimnion into the epilimnion. The high (>300 µg/L) hypolimnetic SRP (and even higher TP, 600 µg/L) accumulated from a recycling process of sediment P back into the water, internal loading, that was enhanced by the severe anoxic conditions. Reducing that source of P is considered the most effective way to reduce epilimnetic TP and chl and improve lake quality.

The principal recommendation is to reduce internal loading, and at the same time, remove most P from the water column, by treating the whole lake with alum, which is aluminum sulfate. Alum hydrolyzes in water producing an aluminum hydroxide floc that settles slowly through the water column sorbing P, as well as tying up particulate matter, and deposits in the sediment surface. There the floc incorporates into the sediment and sorbs sediment pore water soluble P. The dose should be sufficient to inactivate sediment mobile P as well as remove water column TP and SRP. Alum treatments usually reduce internal loading by 70-80% initially, although internal loading usually returns over 5-10 years due to floc settling to greater sediment depth and enrichment of surface sediment.

An alum treatment will also reduce the dissolved humic material that gives the lake a tea- color appearance, in addition to particulate matter, and thereby increase transparency. The tea color will probably reappear in a year due to a continual inflow source. Also, dissolved matter that generates dissolved oxygen (DO) demand may be reduced and hypolimnetic DO levels increased. Reducing chlorophyll (chl) will also mean less DO-demanding organic matter settling into the hypolimnion.

Hypolimnetic aeration may also be used together with alum, in order to enhance DO resources for cold water fish, i.e., trout, although epilimnetic temperatures are probably suitable for trout growth (except at the surface in August and September). Nevertheless, the oxygen demand of the lake sediments is extremely high in Scriber Lake and alum will only reduce this demand a fraction of what is needed to prevent anoxia. Hypolimnetic aeration would aid in internal loading of TP, but not as well as alum due to the Fe limitation relative to TP supply that exists in the lake. Hence, it is recommended to use alum to control TP, however, if there is a desire to improve aquatic habitat then it is also recommended to implement hypolimnetic aeration to the lake. Relative to costs the life-cycle costs of alum versus hypolimnetic aeration will prove to be less expense and more effective in managing the long-term water quality of the lake.

2. Introduction

Scriber Lake was sampled during 2011 and 2012 to determine the state of the lake's quality, the likely causes for its quality, and recommended management alternatives for improvement. The lake's quality was assessed in 1984 and 1985, and recommended rehabilitation measures were undertaken based on that assessment (Welch and Smayda 1986; URS 1986). This current report compares the state of water quality from the two time periods listed above and discusses water quality-controlling factors and effects of rehabilitation measures taken over the intervening years.

Diversion of high storm flows from Scriber Lake and aeration of the lake's hypolimnion were undertaken as recommended by URS (1986). Since diversion structures were installed, only base flows have entered the lake with higher storm flows diverted through the North Lagoon. These measures were apparently only minimally successful in achieving the objectives of improving surface water quality and raising dissolved oxygen (DO) concentrations in the hypolimnion. Subsequent research showed the lake's hypolimnion to have exceptionally high DO demand (Sehgal and Welch 1991) - about 20 times the rate used to design the aeration unit. The efficacy of continued aeration, in light of additional data, will be discussed, as well as other means to improve the lake's quality.

Study Objective

The purpose of the Scriber Lake water improvement project is to explore alternatives to improve the lake's water quality as indicated by water clarity, algal abundance, organic matter content, and increased oxygen content. This can be achieved by several procedures. The project is planned to proceed in a phased approach in order to maximize the effectiveness of implementation activities such as hypolimnetic aeration, phosphorus inactivation, and potentially floating islands. The first step is a study designed to determine which procedure(s) and management alternatives to those procedures would be most cost effective and appropriate for long term management of the lake.

Methods

Water samples were collected from Scriber Lake on nearly a twice-monthly frequency from September to November 2011 and March to October 2012. Samples for total phosphorus (TP), soluble reactive P (SRP), and chlorophyll a (chl) were taken from surface, at 2 meters, and at 4 meters. Water transparency was measured with a Secchi disk at each sampling occasion. Additionally, surface samples were taken and preserved for determining phytoplankton abundance and volume. Zooplankton were collected with a net haul and enumerated on only two occasions: September 2011 and April 2012. Inflow to the lake was sampled on five occasions from November 2011 to March 2012. Aquatic Research analyzed phosphorus and chl by wet chemical methods described in Standard Methods (1998). Phosphorus was determined to a detection limit of 2 µg/L and chl to 0.1 µg/L. Temperature and DO were determined at 1-meter intervals from surface to bottom (approximately 5.5 meters) during each sampling occasion using a multiparameter water quality sonde.

Inflow volume rate was determined for June to September in 1985 and 2012 by estimation from rainfall, using watershed area (567 hectares), and a runoff coefficient (0.26) from URS (1986). There were no direct measurements for inflow during that period in 2012. There were observations made of relative depth of flow through the storm drain culverts, but these observations were not quantitative.

3. RESULTS

Trophic State

Water quality of lakes is usually indicated by variables that define trophic state, or level of productivity. These variables are TP, chl, and water transparency (SD), expressed as summer means (Appendix A). Scriber Lake can still be considered hypereutrophic, as it was in 1985 despite restoration measures that diverted some stormwater and aerated the hypolimnion. These measures apparently had little effect on the lake's quality; summer TP and chl concentrations were greater in 2012 than in 1985 (Table 1). Chlorophyll and TP were predicted to average 9 and 23 µg/L following a projected 75 percent reduction in external TP loading due to diversion (URS 1986).

While storm flows were diverted, base flows were still allowed to enter the lake in order to maintain its volume. Inflow TP averaged 68 µg/L during November 2011 to March 2012 (n= 5), not much different from that period in 1984–1985, which was 54 µg/L. In 1984–1985, winter base inflow averaged 45 µg/L (n= 8) and 112 µg/L (n= 9) during summer. Three storm events (May, October, and December in 1985) averaged 174 µg/L (n= 30). During the low rainfall period and algae blooms in July to August 1985, inflow TP averaged 180 µg/L and inflow SRP, which is available to algae, averaged only 27 µg/L (n=5).

Inflow was not sampled after March 2012 so direct comparisons with data from spring and summer 1984–1985 are not possible. Nevertheless, the summer lake and winter inflow data suggest that inflow TP and SRP probably have not changed much, despite the diversion of high storm flow. Thus, reduction of the inflow volume by 25 percent by diverting storms, equaling 75 percent of the TP load (URS 1986), was apparently insufficient to lower summer TP in the lake and improve water quality.

Table 1. Mean Summer (June-September) Concentrations in µg/L in the Top 2 Meters and Secchi Transparency in Meters of Scriber Lake

Year	TP (50)	SRP	Chl (25)	SD (1)
1985	56	23	40	1.3
2012	80	11	49	1.5

Notes: Hypereutrophic boundaries are in parentheses.

Lake sediments are also a source of lake TP. Hypolimnetic TP increased greatly during summer stratification in 2012 to much higher levels than in 1985 (Figure 1). Concentrations at 2 meters increased to a peak of 170 µg/L in August, apparently affected by the extremely high levels at 4 meters. Chlorophyll also increased to bloom proportions, over 100 µg/L during the summer, especially at 2 meters and associated with high TP over 100 µg/L at that depth (Figure 2). Concentrations of TP and chl were much lower at the surface (Figures 1 and 2). Surface to 2-meter average chl concentrations peaked in summer 2012 to even higher levels as surface to 3-meter averages did in 1985 (Table 1; Welch and Smayda 1986). High algal abundance occurs at 1 to 2 meters below the surface in the lake and does not often form surface scums as is typical in hypereutrophic lakes with highly buoyant blue-green algae.

According to rather frequent inflow monitoring in 1984–1985, high stormwater flow tends to lower inflow TP concentration (Welch and Smayda 1986). During low rainfall (and runoff) in July–August, inflow TP concentrations were high (180 µg/L), presumably due to undiluted base flow. Rainfall was also low during July to September in 2012, so inflow TP is assumed to have been high then as well. Thus, the question arises, was the source of high lake TP during algal blooms in July to August 1985 and 2012 from high, undiluted inflow TP or from the high hypolimnetic TP concentrations internally?

Recycling of P from bottom sediment (internal loading) during the summer stratified period in 2012 was 7.5 mg/m^2 per day, nearly three times the rate determined in 1985 (2.7 mg/m^2 per day). Those rates are consistent with higher hypolimnetic (4 meter) TP (600 µg/L) and SRP (300 µg/L) during July to August 2012 than during that period at 4.5 meters in 1985 (TP, 104-193 µg/L; SRP, 10-84 µg/L). June to September rainfall (see Appendix C) in 2012 (6.4 inches) was similar to that in 1985 (7.1 inches), so TP loading from runoff was probably similar to the 4.6 kg determined during that period in 1985. If so, internal loading during summer 2012, at 5.5 kg, was probably similar to summer external loading in 2012. An important difference is that nearly all of internal loading was SRP (Figure 3), while only a small fraction (15 percent in 1985) of summer external loading was SRP and readily available to algae. Therefore, summer inflow SRP concentrations of 20 to 30 µg/L (22 µg/L 1985) were unlikely to have created peak concentrations of chl and TP well over 100 µg/L at 0 to 2 meters in the lake. More likely, those high concentrations were probably due mostly to diffusion from the SRP concentrations in excess of 300 µg/L at 4 meters that originated from internal loading. That is supported by an estimate of diffusion of SRP from the hypolimnion (below 3 meters) into the epilimnion (above 2.5 meters) of 4.9 mg/m^2 per day during June to September 2012. External loading of SRP during that period in 1985 was only 0.78 mg/m^2 per day into the lake surface - probably similar as in 2012, given similar rainfall runoff. The internal source may have been even more important than inflow in 2012, given that sediment P release rate and hypolimnetic TP and SRP were several times greater than in 1985, and a fraction of the inflow was probably diverted from the lake in 2012.

Dissolved Oxygen

Dissolved oxygen was depleted below 4 meters from June through September, at 3 meters from July, and nearly below 2 meters from August on (Figure 4). The water column fraction devoid of DO through most of the summer and fall is shown in red in Figure 5. Part of the reason for so much of the water column being nearly devoid of DO for so long is the lake's small area (0.9 hectares, 2.3 acres) and corresponding small wind fetch that prevents much natural mixing. As surface water warms in spring, the warmer, less dense water remains on top unless wind mixes it downward. Thus, colder, more dense water remains near the bottom at $\leq$ 10 ˚C, while the surface warms to nearly 22 ˚C (Figure 6). Water below 3 meters receives little oxygen from the atmosphere during the stratified period and, therefore, hypolimnetic DO continues to deplete. In Scriber Lake, the depletion rate is very high. Water column DO demand was determined in September 1987 and April and June of 1988 (Sehgal and Welch 1991). The average rates, determined by the routine biological oxygen demand (BOD) procedure, were 9.6 g/m2 per day at 10 ˚C and 17.1 g/m2 per day at 20 ˚C. Sediment demand was small (0.3 g/m2 per day). The boundary for a eutrophic lake is 0.55 g/m2 per day and lakes very rarely have rates exceeding 1 g/m2 per day. Apparently, the hypolimnetic aeration system was under-designed if the DO demand cited by URS (1986) was used (0.064 g/m2 per day).

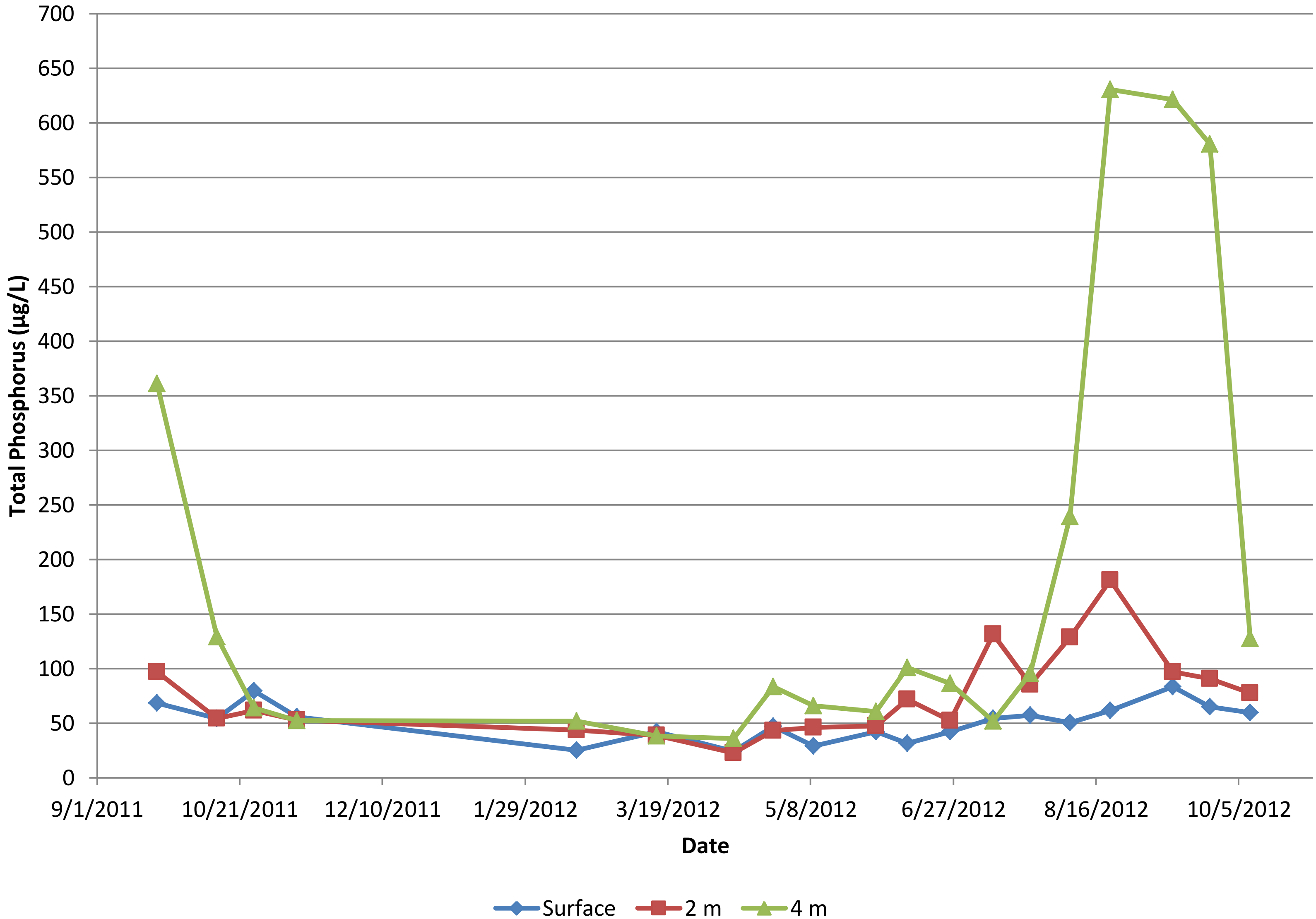

Figure 1. Total Phosphorus Concentrations in Scriber Lake, September 2011 through October 2012

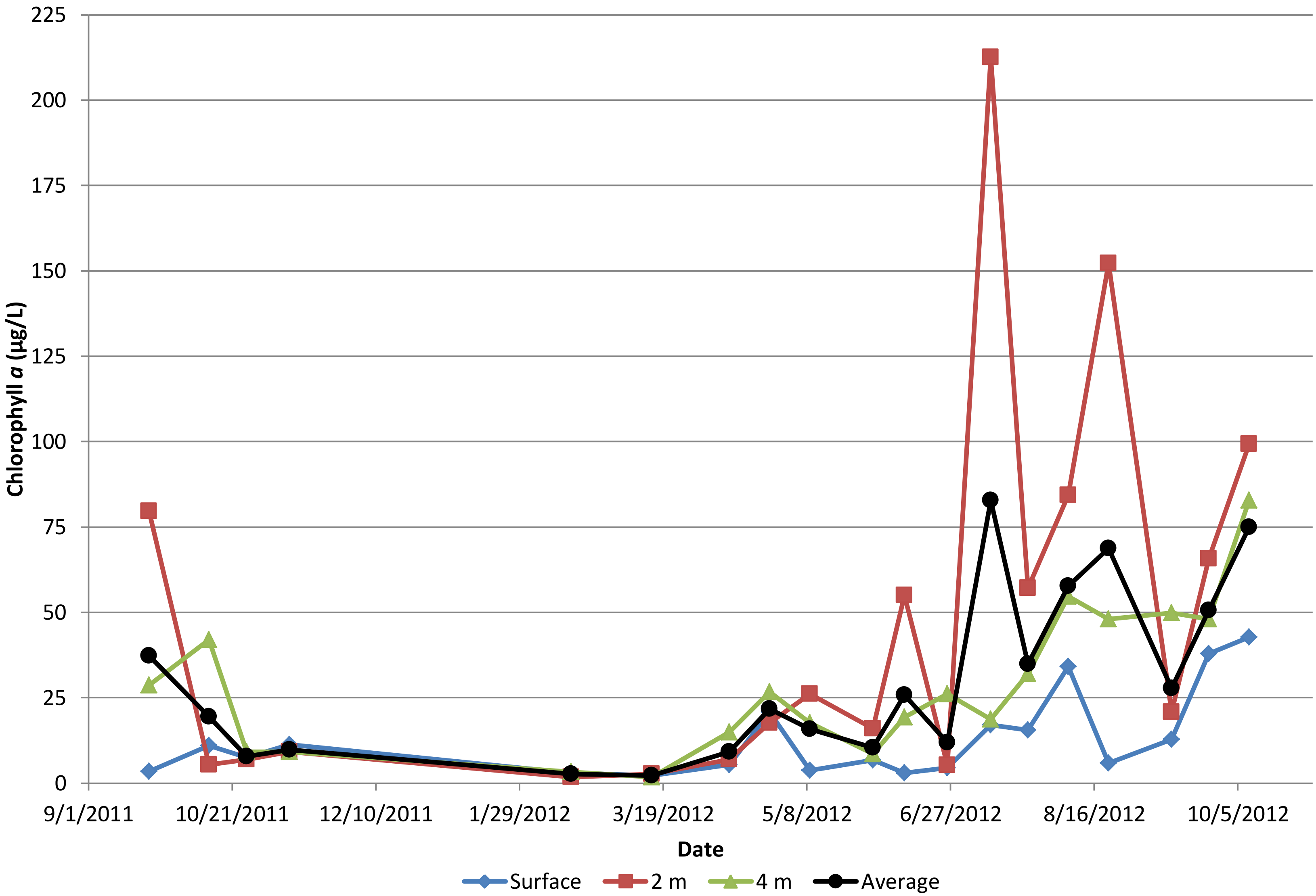

Figure 2. Chlorophyll *a* concentrations in Scriber Lake, September 2011 through October 2012

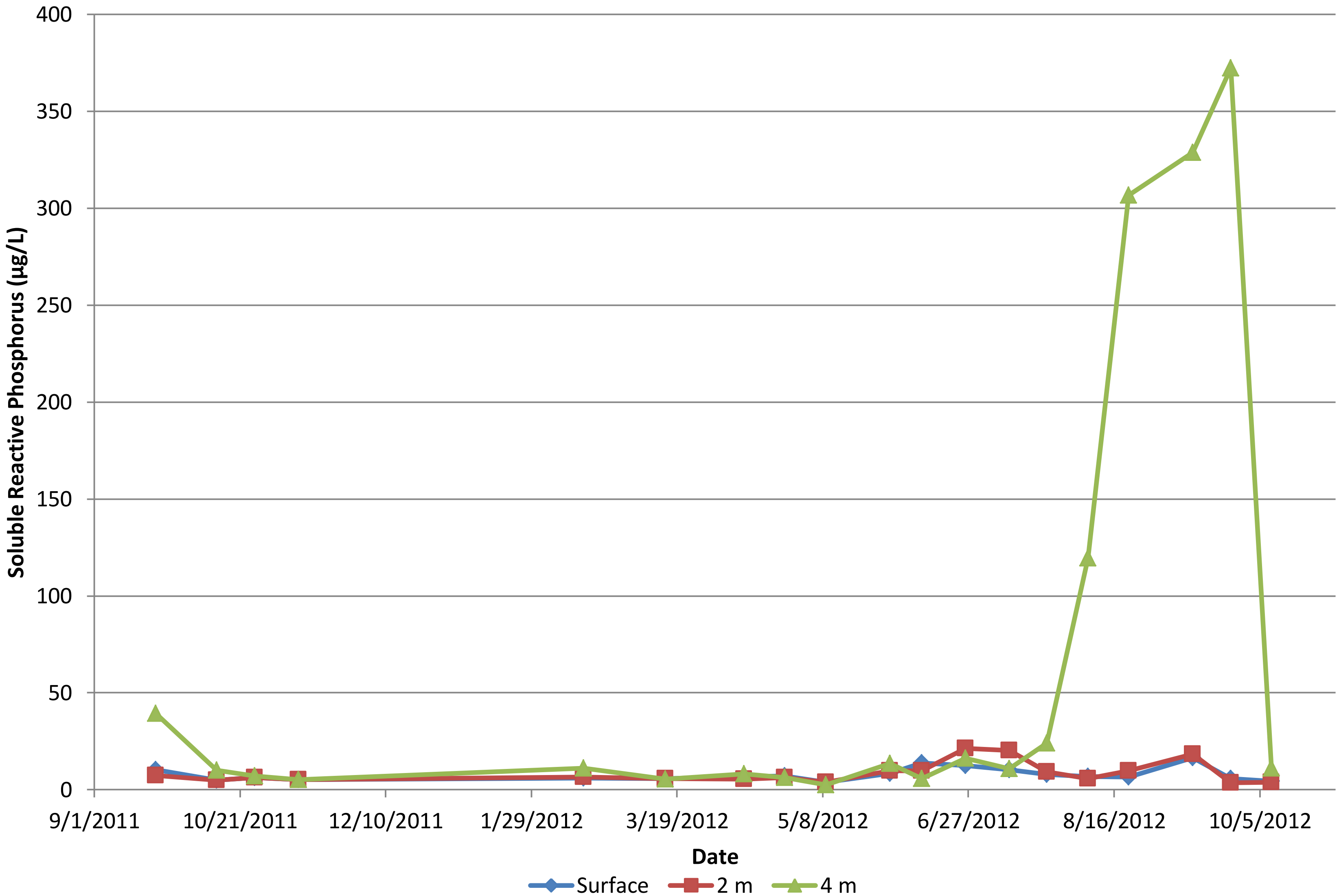

Figure 3. SRP Concentrations in Scriber Lake, September 2011 through October 2012

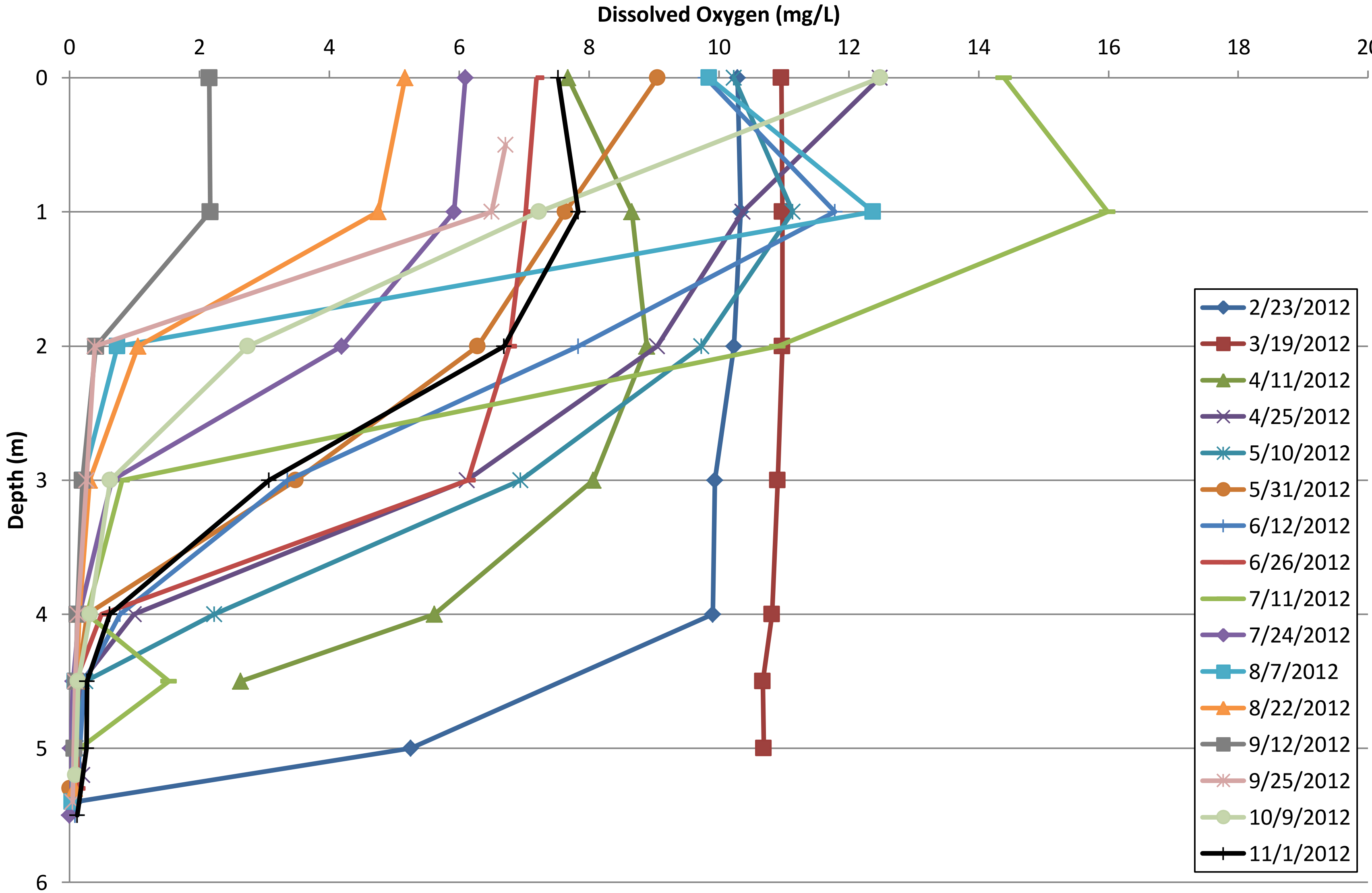

Figure 4. 2012 Dissolved Oxygen Profiles in Scriber Lake

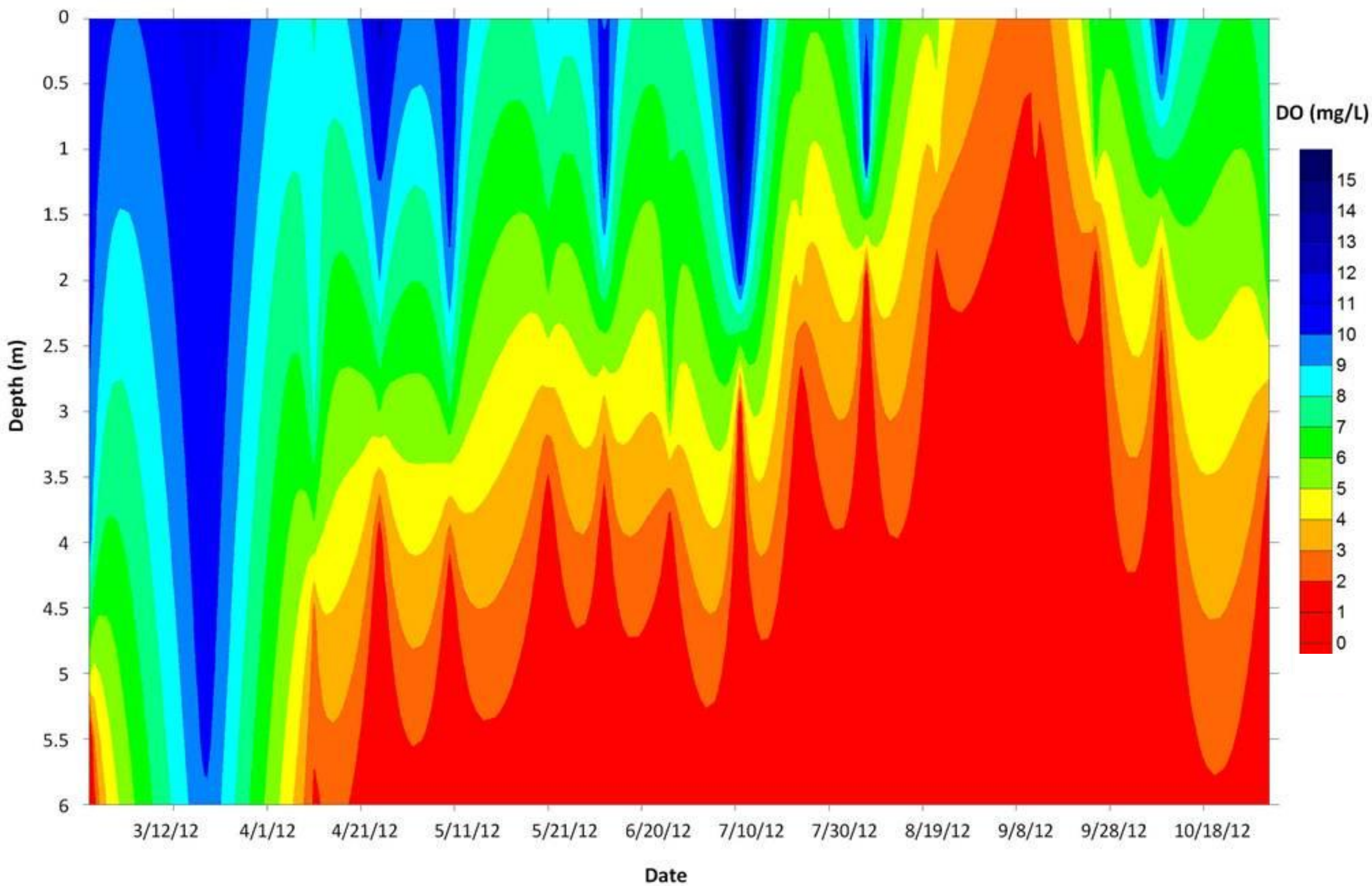

Figure 5. Dissolved Oxygen Isopleth for Scriber Lake

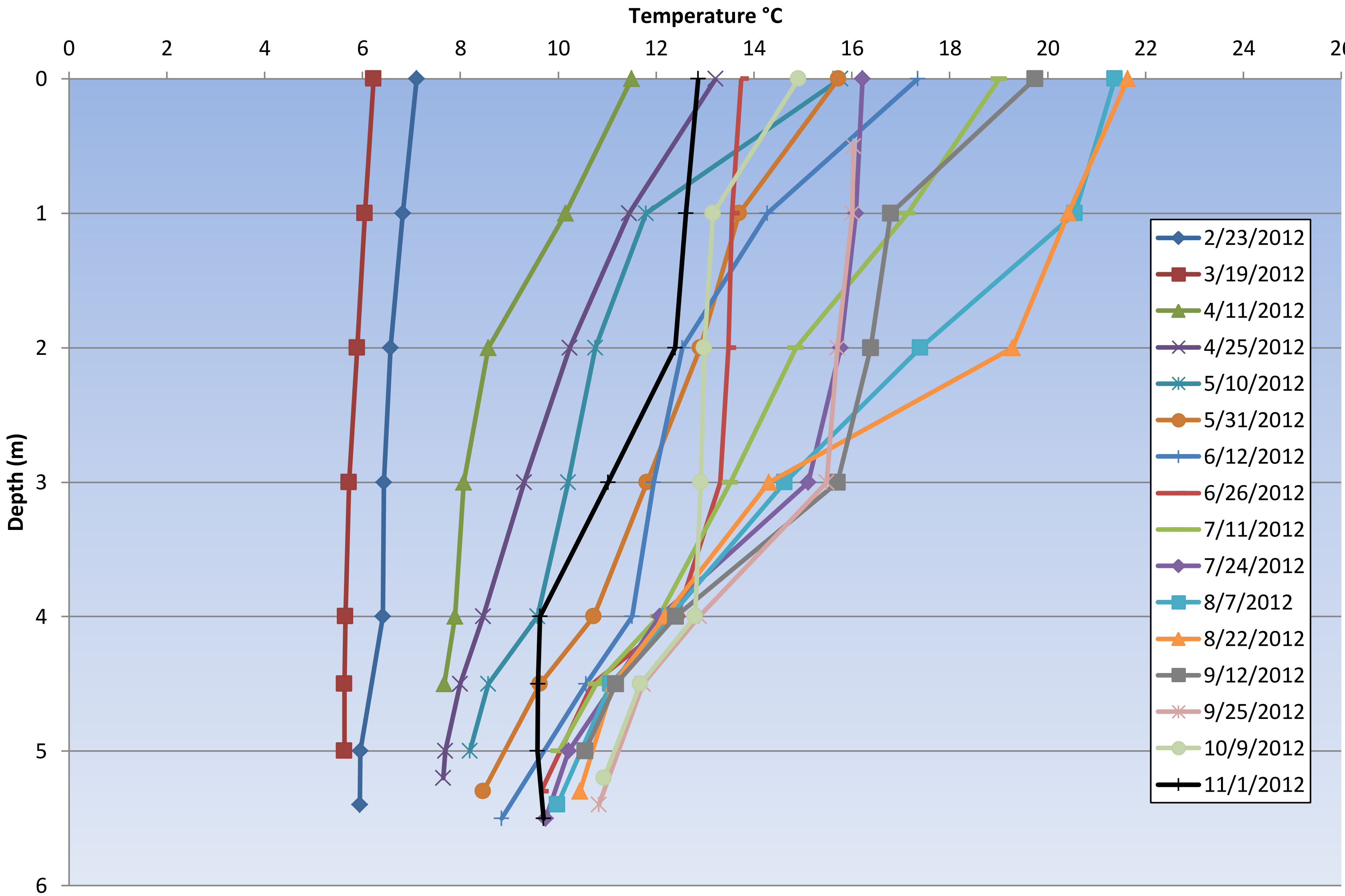

Figure 6. 2012 Temperature Profiles in Scriber Lake

Phytoplankton

The algal blooms in July and August were composed mostly of chrysophytes and small flagellated cryptophytes such as *Cryptomonas* (Figure 7 and Appendix B). This was also the case in 1985. Dominance was especially evident with respect to percentage of total cell volume, which exceeded 10 mm^3/L, a very high biomass (Figure 8). The large biomass was also evidenced by chl exceeding 100 µg/L. The two groups comprised about 90 percent of the phytoplankton biomass during most of the summer. *Oscillatoria* (or *Planktothrix*) a cyanobacteria, was also present at high biomass (Figure 8). Their cell abundance was not as high, because cell size is larger than cryptophytes and chrysophytes. There were no nuisance, scum-forming cyanobacteria species, which is unusual in such a hypereutrophic lake as Scriber.

A moderately high flushing rate may partially account for the absence of cyanobacteria. Runoff during June to September, calculated from rainfall, produced an average flushing rate in the top 3 meters of the lake of 9.2 percent per day in 1985 and 8.4 percent per day in 2012. Even if 25 percent of runoff was diverted in summer 2012, the flushing rate would still have been 5.7 percent per day. Cyanobacteria usually do not grow as fast as the smaller celled chrysophytes and crytophytes and may not be able to cope with such rates. *Oscillatoria* did produce high cell concentrations in August, representing 50 percent of the biomass (Figures 8 and 9). That was during the long drought period starting in late July (see rainfall in Appendix C); they may have responded to what would have been a low flushing rate due to no precipitation and runoff. Measured bi-weekly flow during June through September 1985 averaged only 0.13 cubic feet per second (cfs) and 0.2 percent per day flushing rate, which probably amounted to non-storm base flow. A similar low flushing rate also probably prevailed during summer 2012, as discussed previously, and would have been even lower in August with zero rainfall.

Also, *Oscillatoria* may be the sole cyanobacteria to succeed in the lake, because it tolerates low light (Persson 1981). The poor transparency, coupled with the availability of SRP at 2 to 3 meters from internal loading, may favor that taxon over other cyanobacteria. The reduced inflow during the summer of 2012 also supports the importance of internal loading of P as a driver in the over-production of phytoplankton in the lake. This is demonstrated by comparing the TP peak in August 2012 in Figure 1 with the cyanobacteria biomass peak in Figure 8.

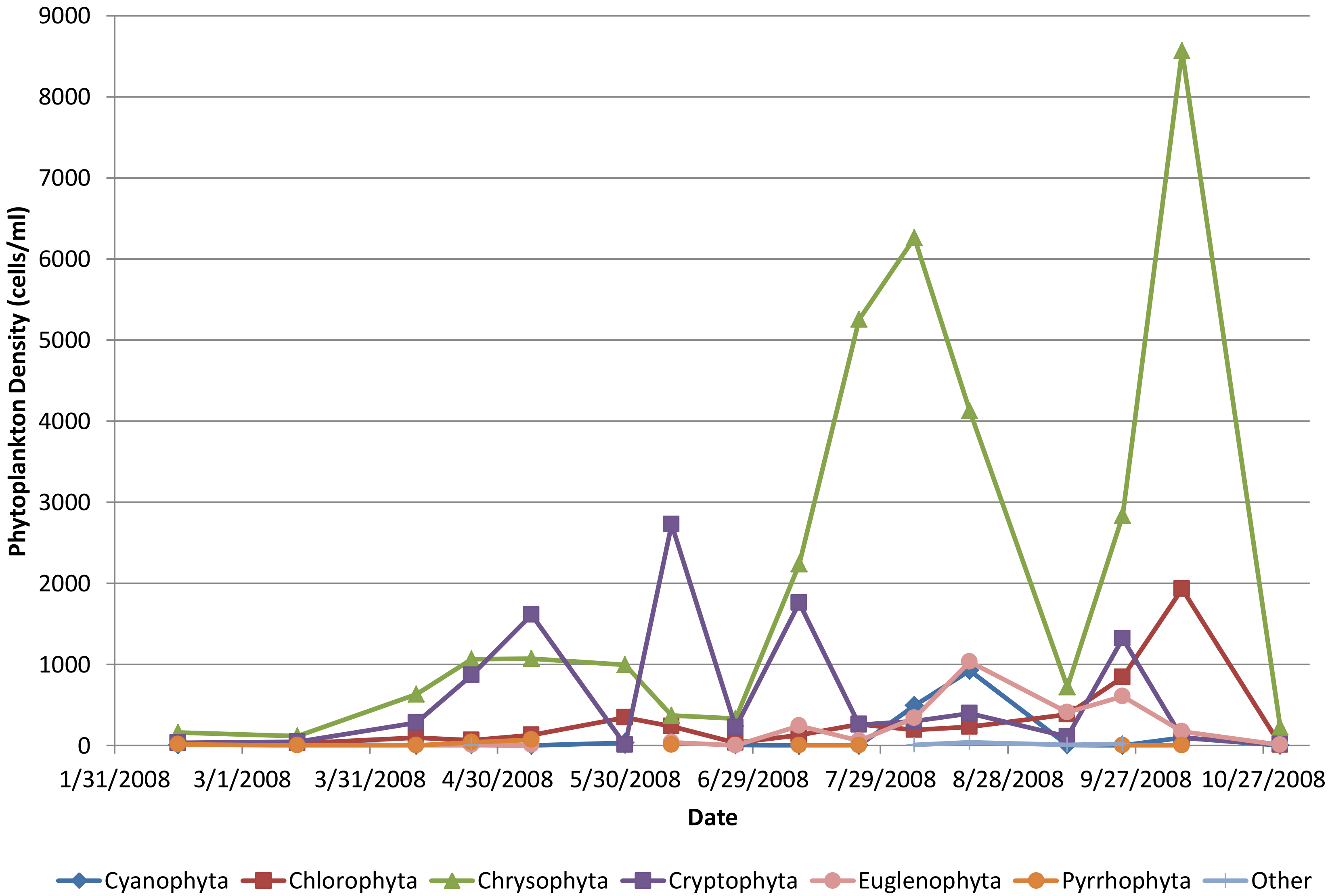

Figure 7. Phytokplanton Density in Scriber Lake, February to August 2012

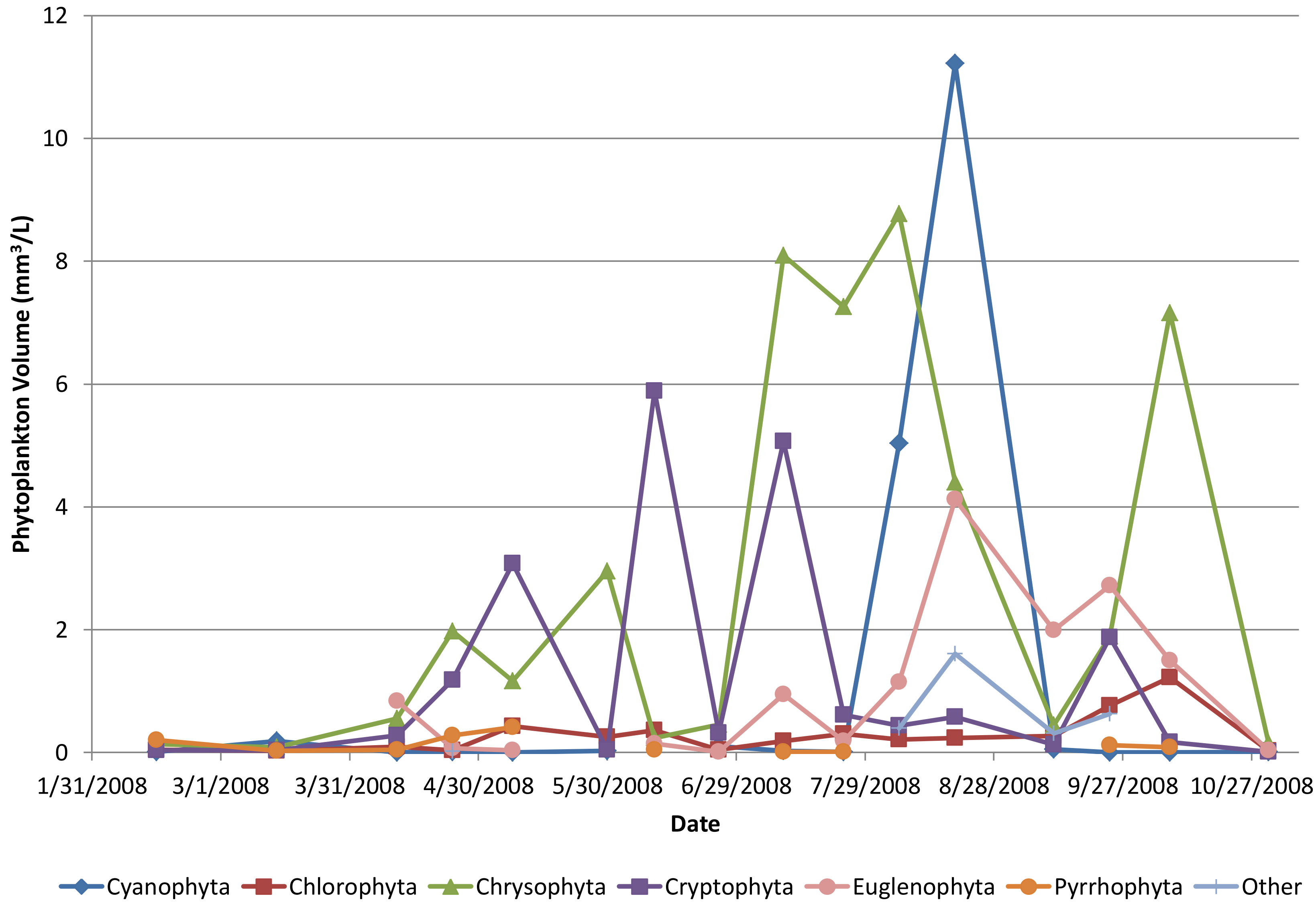

Figure 8. Phytoplankton Volume in Scriber Lake, February to August 2012

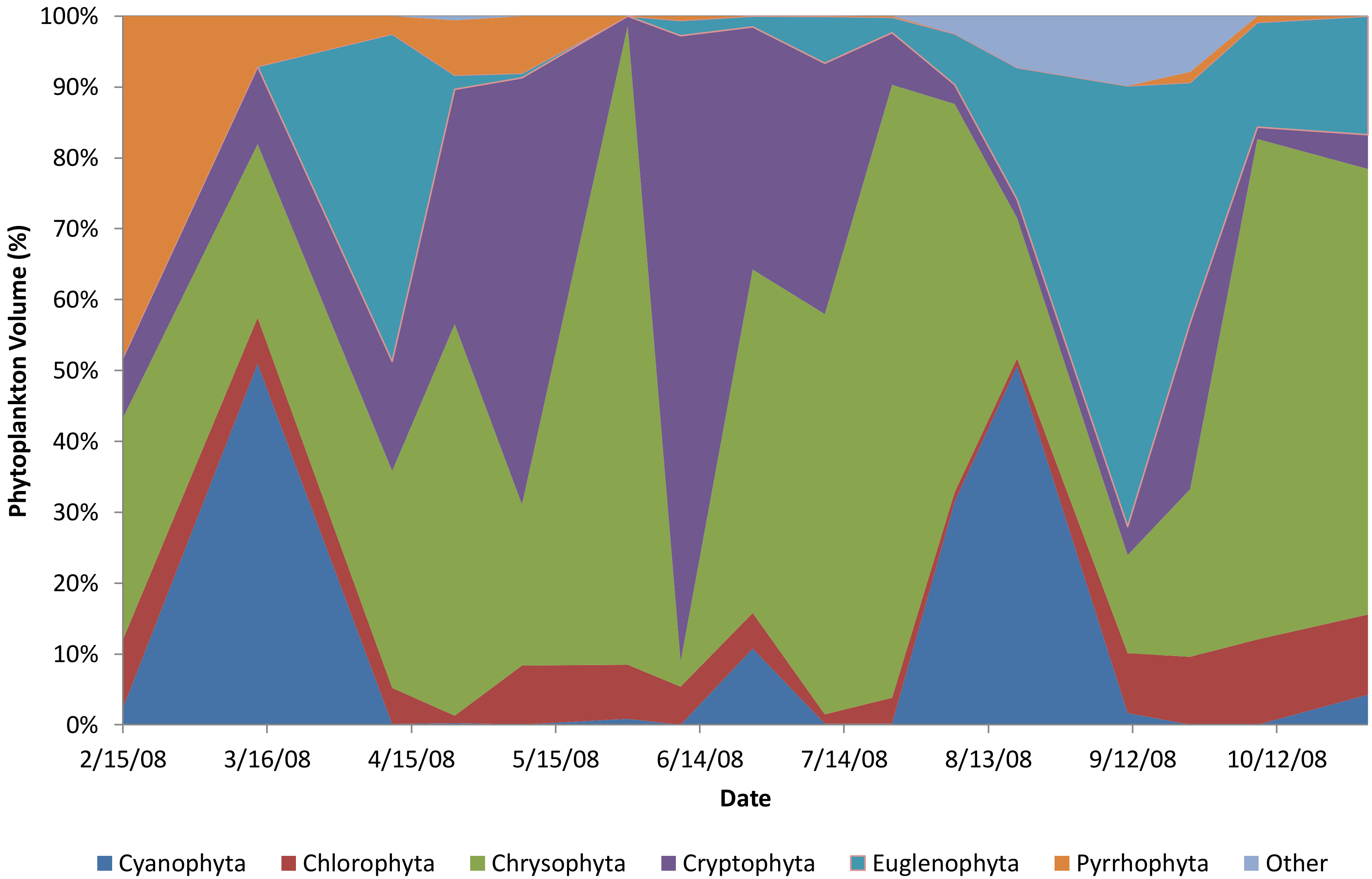

Figure 9. Phytoplankton Relative Dominance as a Percentage of Total Volume

Zooplankton

Animal plankton, especially cladocerans, were very abundant in September and April, the two sampling occasions (Table 2 and Appendix C). *Daphnia* was the main cladoceran at a density over 200/L. That is over 10 times densities in other less productive western Washington lakes. *Daphnia* is a very efficient filter-feeding grazer of phytoplankton and would have efficiently removed the small cryptophytes but not filamentous *Oscillatoria*. Copepods were also relatively abundant and would have also grazed the small phytoplankton. Grazing by zooplankton can effectively remove algae and increase transparency of the water column.

The extent to which zooplankton and their grazing efficiency are adversely affected by low DO is unclear. The high density on September 2011 (Table 2) occurred with DO of 5 mg/L at the surface, 1.5 mg/L at 1 meter and near zero at greater depths. At those concentrations, *Daphnia* was probably restricted to the surface 0.5 meter or so. *Daphnia* was observed to swarm at the surface in the North Lagoon in summer 1985, presumably due to stress from low DO (Welch and Smayda 1986).

Table 2. Zooplankton in Scriber Lake, September 2011 and April 2012

	Zooplankton Density (#/L)			
Date	**Cyclopoid Copepods**	**Nauplii**	**Cladocerans**	**Rotifers**
9/22/2011	36	80	265	104
4/25/2012	36	72	68	32
	Zooplankton Biomass (ug/L)			
Date	**Cyclopoid Copepods**	**Nauplii**	**Cladocerans**	**Rotifers**
9/22/2011	229	20	943	1
4/25/2012	409	18	387	0

4. DISCUSSION

The state of water quality in Scriber Lake has not changed since 1985. Summer mean concentrations of TP and chl in 2012 still indicate hypereutrophy. Although transparency is slightly above the hypereutrophic boundary (1 meter), it was still quite low and similar to that in 1985. However, unlike nearly all hypereutrophic lakes, nuisance cyanobacteria that form scums and pose a high toxic risk were not present. Although the cyanobacteria in Scriber Lake can produce microcystins, they produce toxins at a lower level than other common cyanobacteria found in hypereutrophic lakes such as *Microcystis*. Instead, the phytoplankton was composed of mostly small-celled, flagellated algae as in 1985, although one non-scum-forming cyanobacteria (*Oscillatoria*) did reach high abundance in late summer 2012 and was also present in 1985 (Welch and Smayda 1986).

The reasons for dominance by small-celled, flagellated algae may be related to the flushing rate, which is much higher than in most lakes because the lake's volume is small relative to its rate of inflow especially from storm runoff. Average June to September flushing rate of the top 3 meters of the lake's water column (epilimnion) was, theoretically, 8 to 9 percent per day, based on rainfall runoff in both 1985 and 2012. Most of the inflow occurred in June and part of July both years, so flushing rates were much lower during late July to September, which was the period of algal blooms. Also, the small-celled, flagellated algae have faster growth rates than cyanobacteria and can directly control their position in the water column. Nuisance cyanobacteria, in contrast, are buoyant some of the time, being controlled by conditions affecting cell status, and probably would be more susceptible to washout from the surface meter or so. *Oscillatoria* does not form massive scums and is favored by low light, so it tends to concentrate well below the surface. Nevertheless, the lake's high TP concentrations produce high algal concentrations, which are partly responsible for the low water transparency.

Most of the high epilimnetic TP during the low-inflow period appears to come from internal loading, rather than external. Importantly, internal TP was nearly all soluble (SRP), which is more available to algae, while the soluble fraction in the inflow was relatively small. That was the case in 1985 and probably in 2012 as well, although the inflow was not sampled during spring-summer in 2012. While external TP loading to Scriber Lake was extremely high, even in early summer (1985), most of that P passed through the lake rapidly. Therefore, the non-soluble P fraction has insufficient time to become available, so only the inflow SRP concentration was available to algae, and too small (22 µg/L in 1985) to account for blooms over 100 µg/L chl. The lake SRP concentration cannot physically exceed the inflow concentration if the latter is the only source. In contrast, hypolimnetic (4-meter) SRP exceeded 300 µg/L, providing a high gradient for diffusion to the epilimnion. Timing of the algal blooms associated with high TP in the epilimnion was coincident with the high SRP and TP in the hypolimnion. The very high SRP and TP concentrations at 4 meters are proximal to the epilimnion (3 meters), which would favor diffusion in this shallow lake. Normally, an intermediate metalimnion of several meters thickness separates the epilimnion and hypolimnion in much deeper and larger lakes (e.g., 6 meters in Lake Sammamish). Scriber Lake is very stable due to its depth, small area, and protection from wind, allowing relatively small density differences to persist over small depth increments.

Transparency, averaging 1.5 meters during June through September, was actually greater than expected. Given an average chl concentration (0 to 2 meters) of 49 µg/L, transparency should have averaged only 0.5 meter (equation from Carlson 1977). Part of the reason is that chl at 2 meters averaged 125 µg/L and only 17 µg/L at the surface during July to August. Expected transparency for 17 µg/L chl is 2 meters, so transparency was probably more dependent on the much lower surface chl concentration.

The lake's often dingy appearance is mostly caused by its low transparency. Some of the poor transparency is probably due to non-algal particulate organic matter produced in the lake as well as coming from stormwater. Diversion of one-third of the stormwater, and its entrained particulate matter, apparently has had little effect on summer transparency. In-lake production of organic matter from loosely aggregated and flocculated mats of bog moss (*Sphagnum*) along the shore was hypothesized to cause some of the lake's poor transparency and high water column oxygen demand (Sehgal and Welch 1991). The lake's small area would make it susceptible to a shoreline source.

Hypolimnetic aeration was proposed to satisfy the high hypolimnetic DO demand by oxidizing much of the organic matter, as well as reducing hypolimnetic P. The aeration unit was under-sized so DO concentrations remained low. Unit design may have been based on an estimated demand that was as much as 20 times too low. However, the high hypolimnetic demand (13 g/m^2 per day) determined with lake water in the laboratory may have been much higher than the actual demand exerted *in situ* under continuous aeration without the opportunity for organic matter buildup that would eventually occur under anoxic conditions (Sehgal and Welch 1991).

While partial diversion of stormwater is still a good idea to minimize lake sediment buildup (0.30 cm/yr, 1985), it probably poses little benefit during summer low flow in terms of TP and chl reduction. An alternative with more promise to lower TP and chl, and possibly hypolimnetic DO demand as well, is an annual alum application. The alum floc would remove most of the TP, SRP, and organic particulate matter from the water column and inactivate mobile P in bottom sediment, reducing internal loading. Treatment around July 1 would avoid significant replacement of epilimnetic TP from inflow, but more importantly would remove the high TP and SRP from the hypolimnion, greatly reducing sediment P release (internal loading) and, hence, the rate of diffusional transport of SRP to the epilimnion. Reduced internal loading may persist for several years, but low dose annual treatments may be necessary to remove TP accumulated each spring from inflow. However, subsequent base inflow would not be suspected to cause algal blooms due to its low SRP concentration. The success of this measure and need for additional water column treatment would be determined from ongoing monitoring.

Hypolimnetic DO should also increase as a result of initially removed organic matter, as well as reduced algal production, which also supplies DO-demanding organic matter to the hypolimnion. However, an increase in hypolimnetic DO may only be expressed as a shortening of the anoxic period, and this may take many years to see improvement due to the legacy DO demand within the sediments.

Reducing TP and increasing hypolimnetic DO would improve survival of the larger zooplankton, *Daphnia*, which is very abundant at times in the lake. *Daphnia* is highly effective at filtering out algae and their increase is often targeted in lake restoration efforts because their effective reduction of algae can greatly improve transparency. Their survival and production in the lake may be limited at times due to very low DO in most of the water column when the algal blooms occur. With improved DO, *Daphnia* may be more effective at reducing algae. Nuisance filamentous and colonial cyanobacteria are largely unavailable to grazing *Daphnia*, but the small-celled bloom formers in Scriber Lake would be very susceptible to grazing. On the other hand, the low DO may be limiting fish and, thus, precluding planktivory, allowing the high densities of *Daphnia*. Whether an alum treatment would benefit *Daphnia* through increased DO, or result in increased fish abundance and planktivory is unclear. Thus, monitoring the lake's response is important to adapt management to achieve the goal of improved lake quality.

5. SUMMARY

- The state of water quality in Scriber Lake in 2012 indicates hypereutrophy, based on summer chl and TP, as was the case in 1985. Transparency was slightly greater than the hypereutrophic boundary but was still low, as in 1985.
- Nuisance, scum-forming cyanobacteria were not common in the lake during the study, despite the high TP, in contrast to most any other hypereutrophic lake. Instead small-celled, flagellated algae were most abundant during spring to summer, causing large blooms. However, a non-scum forming cyanobacteria occurred in high abundance in late summer. The algal assemblage and timing was similar to that in 1985.
- The dominance by small-celled algae may be due in part to the high flushing rate in a lake as small as Scriber. The lake's small size, relative to the rate of inflow, means small-celled, fast growing algae have an advantage over larger colonial and filamentous types. Even diversion of one-third of the stormwater has not altered the summer algal picture. Nevertheless, the algal blooms occurred in July through August during both 1985 and 2012 when inflow, indicated by rainfall, was low.
- The high TP associated with algal blooms in the epilimnion probably originated mostly via diffusion of high SRP in the hypolimnion, where it reached concentrations exceeding 300 µg/L during summer. The high chl concentrations exceeding 100 µg/L, requiring an equivalent or more TP, could not be caused by inflow SRP, available to algae, that was probably 20 to 30 µg/L (average 22 µg/L in 1985; no inflow samples in 2012).
- Hypolimnetic aeration is not recommended until P inactivation has been studied as to its impact on the lake's metabolism. Previous attempts at aeration underestimated the very large water column DO demand. Even if a high rate of aeration/oxygenation were to render the hypolimnion aerobic, sediment P release may not decline sufficiently or at all - that depends on sediment iron content, which is unknown. Also, adequate aeration would run the risk of disturbing stratification in such a shallow water column, which could increase the transport of hypolimnetic P to the epilimnion.
- Summer algal blooms would be reduced and transparency increased by stripping the water column of SRP and TP with an alum (aluminum sulfate) treatment at the beginning of summer. The treatment would also inactivate sediment P, reducing internal loading probably 70 to 80 percent, as is usually the case. Hypolimnetic DO demand may decline because particulate and dissolved organic matter, originating from sinking algae and nearshore sources, would be sorbed and settled out with the alum floc.
- Hydroponic docks (floating vegetative docks) are not recommended because they may in fact reduce water quality conditions in Scriber Lake. This is due to the specific environmental dynamics that are unique to this lake, specifically, the lake's high flushing rate. With the establishment of vegetation on floating platforms, the effective P flushing, removal from the

lake would be reduced because of the P absorption onto the roof complex below the docks. The plants would accumulate P. This P would then settle to the sediments instead of being flushed out of the lake, increasing the potential for P recycling from sediment and increased cyanobacteria production. The second concern is that hydroponic docks will reduce light in the water column. Usually this is a net benefit- less light = less photosynthesis; however, low light conditions in the lake already provide a competitive advantage for cyanobacteria over other phytoplankton. With the establishment of hypolimnetic docks, there could be a prolonged period of cyanobacterial dominance in the lake.

6. RECOMMENDATIONS

Phosphorus Inactivation

- *Treat the lake with alum (aluminum sulfate) to reduce water column P and inactivate sediment P*. This should reduce lake TP and internal loading by 70 to 80 percent as well as algal biomass. The lake should be treated around July 1, which has been about the onset of reduced flushing and the increase in hypolimnetic P and algae. That timing of an alum treatment should avert the large TP and algae (chl) maximums that occurred in August and September. There should not be the large percentage of hypolimnetic P buildup supplying the epilimnion and algae in the lighted epilimnion. Also, the reduced summer flushing rate should not appreciably replenish epilimnetic P, especially with soluble P, because inflows have been low in SRP, which is available to algae.

  Summer algal biomass will decrease with the reduction in available P due to the annual alum treatments. Also the deposition of algal-derived organic matter should reduce the DO demand in the hypolimnion and improve habitat for cold water fish (i.e., trout). Alum will also deplete dissolved and particulate organic matter accumulated in the hypolimnion, contributing to the reduction in DO demand, although it may take a year or more of reduced algal production before a large reduction in DO demand is observed after an alum treatment.

  Alum will also temporarily reduce the lake's brown, tea-like color, which is caused by humic substances from the surrounding wetlands. It will increase light penetration and transparency, which may increase algal photosynthesis, except that P reduction will restrict biomass to much lower concentrations preventing blooms as occurred in 2012.

- *Monitor Scriber Lake to observe treatment longevity*. Monitoring should continue to determine if, and the extent to which lake levels of P reestablish due to high winter storm flow and P loading. Those observations will determine if annual treatments at lower alum doses may be deemed necessary.

Hypolimnetic Aeration

- *Oxygenate the hypolimnion to enhance fish habitat*. Reduction of P and algal biomass should also reduce DO demand and raise DO concentrations in the hypolimnion, although that benefit has not been well documented following alum treatments. However, aerobic benthic invertebrate organisms have become more abundant and diverse following treatments (Cooke, etal., 2005). Nevertheless, replacement or retrofit of the aeration system at the outset, coupled with the alum treatment, will ensure that DO habitat is improved. Near-pure oxygen in fine bubbles would be used, instead of air, to minimize disruption of the thermocline and to maintain the cold hypolimnion. While oxygenation, along with alum, would improve habitat, waiting at least a year or more to observe the effects of alum may prove more cost effective if the alum treatment sufficiently improves DO habitat, and that is the approach recommended.
- *Replace or retrofit the aeration system*. Near-pure oxygen would be used to improve DO habitat and reduce P internal loading from hypolimnetic sediment without alum. While oxygenation would probably be more effective than alum at improving DO habitat, it is much less effective than alum at reducing P internal loading and would be totally ineffective at removing color, and improving transparency.

Inflow Control

- *Retain the inflow structure, designed to divert 25 percent of the high storm inflow*. While that diversion removes some of the TP loading (in winter), it probably has little effect on summer lake TP, which is more affected by internal loading. Nevertheless, the diversion of suspended solids with high flow probably reduces the rate of lake filling with sediment and its sorbed P.

Monitoring

- *Monitor the lake and inflow*. The inflow gauge should be read continuously. Flow was not recorded during spring-summer 2012, limiting the interpretation of lake constituent behavior. Water column DO and temperature should be determined twice monthly during mid-May through September, along with discrete samples for TP and SRP at the surface, 2 meters, 3 meters, and 4 meters. Samples for chl should be collected at surface, 2 meters, and 3 meters, and for algal composition at the surface at the same frequency. Secchi disk transparency should also be determined. These data are necessary to evaluate the success of measures employed to improve lake quality.

7. ALTERNATIVE COSTS

Alum

The alum dose is usually determined by sediment P- fraction data, showing the quality of P that is mobile, but such sediment core data are not available for Scriber. Sediment core data from 1985 shows that sediment TP ranged from about 0.8 to 2.5 mg/g with a median of about 2 mg/g from surface to 30 cm, and below that reached a background (in peat) of about 0.5 mg/g. Stable Pb measurements on cores in 1985 indicated that 30 cm corresponded to about 1930 (start of lead in gasoline), with sedimentation rates since then at approximately 0.55 cm/yr. So in the intervening 25 years, an additional nearly 14 cm would have deposited, presumably with TP concentrations similar to the 2 mg/g in 1985 (Welch and Smayda 1986). Without a measure of the mobile P fraction, the sediment P release rate will be relied on to estimate dose.

The sediment release rate was estimated at 7.5 mg P/m^2 per day for 90 days, and applying a ratio of Al added: Al-P (mg/m^3) inactivated, of 50:1 yields a sediment dose of 33.8 g Al/m^2. Adding in the water column P of 80 µg/L times mean depth (3.6 m) and using the Al:Al-P ratio of 50 yields a water- column sediment dose of 14.4 g Al/m^2. Together, the total dose is 48.2 g Al/m^2. Essentially, the sediment P release rate represents the fraction of TP that is releasable during the stratified period. This dose is probably much less than if mobile P were used given the high TP in Scriber Lake sediments. The dose to Green Lake in 2004, calculated from sediment mobile P, was 96 g/m^2, and TP in Green Lake sediments was half that in Scriber Lake. To compensate for the higher sediment TP in Scriber Lake, the dose will be doubled to 96 g/m^2 matching that to Green Lake. Dose will be added to meet a water column volumetric concentration (aerial dose/mean depth [3.6 m]) of 26.7 mg Al/L.
At the inactivation dose of 26.7 mg Al/L, the volume of alum needed would be 4,000 gallons. The first inactivation treatment would cost an estimated $29,000 including $16,000 for materials, $8,000 for application costs, and another $5,000 for bid specs and permitting. Subsequent annual water column P stripping treatments would require 200 gallons of material at $5,200.

Aeration

For alum treatment plus aeration, an oxygen demand of 13 g/m^2 per day, determined from an *in vitro* study in the laboratory, will be used to size the oxygenation system (Sehgal and Welch 1991). Given an area of 5,598 m^2 at 3 meters depth (top of the hypolimnion), times 13 g/m^2 per day, the DO demand is estimated at 72.8 Kg DO/ day.

At this DO demand, retrofitting or replacing the existing system would cost an estimated $100,000 with an additional $8,000 to $10,000 for annual operation and maintenance.

8. REFERENCES

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APPENDIX A: WATER QUALITY DATA

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Table 1. Scriber Lake Water Quality Data.

Date	TP (ug/L)			SRP (ug/L)			chla (ug/L)		
	Surface	2 m	4 m	Surface	2 m	4 m	Surface	2 m	4 m
9/22/2011	69	97	361	10	7	39	3	80	29
10/13/2011	54	54	129	5	5	10	11	5	42
10/26/2011	80	61	64	6	6	7	7	7	9
11/10/2011	56	53	52	5	5	5	11	9	9
2/16/2012	25	43	52	6	6	11	3	2	3
3/15/2012	42	38	38	6	6	6	2	3	2
4/11/2012	24	23	36	7	5	8	5	7	15
4/25/2012	47	43	83	7	6	6	21	18	27
5/9/2012	29	46	66	4	4	3	4	26	18
5/31/2012	42	48	60	9	10	14	7	16	9
6/11/2012	31	72	101	14	10	6	3	55	19
6/26/2012	42	52	86	12	21	16	4	5	26
7/11/2012	54	131	52	10	20	11	17	213	19
7/24/2012	57	85	96	8	9	24	15	57	32
8/7/2012	50	129	239	7	6	119	34	84	55
8/21/2012	61	181	630	7	10	307	6	152	48
9/12/2012	83	97	621	17	19	329	13	21	50
9/25/2012	65	91	580	6	4	372	38	66	48
10/9/2012	59	77	128	4	4	11	43	99	83

Table 2. Scriber Lake Secchi Disk Depth.

Date	Secchi Disk Depth (m)
9/22/2011	1.75
10/13/2011	1.1
10/26/2011	1.3
11/10/2011	0.9
2/23/2012	1.7
3/19/2012	0.7
4/11/2012	1.7
4/25/2012	1.4
5/9/2012	1.7
5/31/2012	2
6/11/2012	1.7
6/26/2012	1.8
7/11/2012	1.4

7/24/2012	1.5
8/7/2012	1.5
8/21/2012	1.9
9/12/2012	1
9/25/2012	1.5
10/9/2012	0.9
11/1/2012	0.9

Table 3. Scriber Lake Inlet TP Concentrations.

Scriber Inlet

Date	TP (ug/L)
11/23/2011	80.5
1/17/2012	33.8
1/23/2012	19.2
2/21/2012	60.2
3/5/2012	105.3
3/12/2012	111.4

Table 4. Scriber Lake Field Measurements.

DateTime M/D/Y	Temp C	SpCond uS/cm	Depth m	pH	pHmV mV	ODO% %	ODO Conc mg/L
9/23/2011 13:33	19.38	188	0	7.18			5.08
9/23/2011 13:36	16.82	190	1	6.95			1.41
9/23/2011 13:54	16.08	190	2	6.89			0.26
9/23/2011 13:47	14.11	231	3	6.67			0.03
9/23/2011 13:49	11.02	398	4	6.85			0
10/7/2011 15:12	14.36					46	4.7
10/7/2011 15:16	13.5					31.9	3.32
10/7/2011 15:19	12.25					2.2	0.24
10/13/2011 11:21	12.99	141	0	6.79	3.4	10.2	1.07
10/13/2011 11:26	12.51	140	1	6.68	9.5	7.5	0.79
10/13/2011 11:29	12.47	140	2	6.67	10	6.9	0.74
10/13/2010 11:31	12.39	144	3	6.66			0.64
10/13/2011 11:33	12.17	187	4	6.55	16.6	6.6	0.7
10/14/2011 15:51	12.31	158	2.5	6.72	7.6	0.6	0.07
10/14/2011 15:53	12.19	162	3	6.71	8.2	2.6	0.28
10/14/2011 15:55	12.16	166	3.5	6.66	10.6	0.7	0.08

10/14/2011 15:57	11.85	293	4	6.68	9.7	0.3	0.03
10/14/2011 15:59	10.73	583	4.5	6.81	2.2	0	0
10/14/2011 16:00	10.27	745	4.8	6.93	-4.4	-0.3	0
10/26/2011 11:01	10.83	158	0	6.72	6	24.3	2.69
10/26/2011 11:05	10.84	158	1	6.72	6.1	21.3	2.36
10/26/2011 11:06	10.81	158	2	6.72	6.2	19.5	2.16
10/26/2011 11:09	10.8	159	3	6.73	5.7	19	2.11
10/26/2011 11:10	10.73	189	4	6.66	9.6	10.5	1.17
10/26/2011 11:12	10.74	538	4.5	6.77	3	2.5	0.27
11/10/2011 15:55	7.88	156	0	6.93	-5.8	13	1.54
11/10/2011 15:57	7.46	156	1	6.84	-0.9	9.5	1.15
11/10/2011 16:10	7.43	157	2	6.8	1.7	9.1	1.1
11/10/2011 16:00	7.42	158	3	6.81	1.1	12.2	1.47
11/10/2011 16:03	7.53	182	4	6.75	4.1	8.8	1.06
11/10/2011 16:05	7.9	305	4.5	6.88	-3.2	2.9	0.34
11/10/2011 16:19	8.74	606	5	6.94	-6.6	0	0
11/10/2011 16:20	8.81	616	5.1	6.98	-8.9	-0.3	0
11/17/2011 15:00	7.16	108	0	7.06	-13.2	58.7	7.1
11/17/2011 15:05	6.65	125	1	6.88	-2.8	35.6	4.36
11/17/2011 15:10	6.46	141	2	6.82	0.4	23.7	2.92
11/17/2011 15:12	6.44	149	3	6.8	1.5	16.9	2.08
11/17/2011 15:16	6.52	155	4	6.77	3.1	9.1	1.12
11/17/2011 15:17	6.55	162	4.5	6.75	4.2	5.1	0.63
11/17/2011 15:20	8.35	860	5	7.01	-10.1	0	0
2/23/2012 16:04	7.11	113	0	7.25	-27.9	85	10.29
2/23/2012 16:07	6.82	113	1	7.19	-24.7	84.8	10.34
2/23/2012 16:08	6.57	111	2	7.14	-22	83.4	10.23
2/23/2012 16:11	6.44	112	3	7.11	-20	80.8	9.94
2/23/2012 16:13	6.42	113	4	7.09	-18.8	80.5	9.91
2/23/2012 16:17	5.96	137	5	6.85	-5.9	42.2	5.26
2/23/2012 16:21	5.94	179	5.4	6.65	5.5	0.7	0.09
3/19/2012 14:47	6.23	112	0	7.54	-46.4	88.6	10.96
3/19/2012 14:49	6.05	112	1	7.43	-40.6	88.3	10.98
3/19/2012 14:52	5.89	113	2	7.35	-35.9	88	10.98
3/19/2012 14:55	5.72	113	3	7.28	-32.1	87.1	10.91
3/19/2012 14:57	5.65	114	4	7.23	-29.2	86.2	10.82
3/19/2012 15:00	5.63	113	4.5	7.19	-27.3	85	10.68
3/19/2012 15:01	5.63	113	5	7.17	-25.7	85.1	10.69
4/11/2012 13:45	11.5	171	0	6.99	-16.9	70.5	7.68
4/11/2012 13:48	10.15	173	1	7.06	-20.5	77.1	8.66
4/11/2012 13:51	8.57	153	2	7.06	-20.6	76.1	8.89

4/11/2012 13:56	8.07	148	3	7.03	-18.9	68.3	8.07
4/11/2012 13:58	7.89	149	4	6.94	-14	47.3	5.62
4/11/2012 14:01	7.67	154	4.5	6.83	-7.9	22.1	2.64
4/25/2012 14:14	13.21	149	0	7.53	-48.2	119.1	12.48
4/25/2012 14:17	11.45	153	1	7.31	-35.4	95	10.37
4/25/2012 14:19	10.23	134	2	7.2	-29.4	80.6	9.05
4/25/2012 14:22	9.3	135	3	7	-18.1	53.4	6.12
4/25/2012 14:27	8.47	154	4	6.78	-5.4	8.4	0.99
4/25/2012 14:29	7.99	189	4.5	6.69	-0.3	1.6	0.19
4/25/2012 14:31	7.69	272	5	6.69	-0.7	0.8	0.1
4/25/2012 14:32	7.65	297	5.2	6.7	-0.9	1.7	0.2
5/10/2012 14:13	15.77	144	0	7.66	-58.1	103.2	10.23
5/10/2012 14:16	11.79	139	1	7.37	-41.3	102.9	11.14
5/10/2012 14:18	10.76	131	2	7.27	-35.4	87.7	9.73
5/10/2012 14:22	10.2	128	3	7.09	-25.3	61.9	6.95
5/10/2012 14:25	9.57	128	4	6.88	-13.6	19.5	2.23
5/10/2012 14:29	8.57	206	4.5	6.75	-6.1	2.2	0.25
5/10/2012 14:34	8.19	244	5	6.83	-10.8	0.8	0.1
5/31/2012 14:26	15.73	139	0	7.43	-46.2	91.2	9.06
5/31/2012 14:32	13.7	153	1	7.11	-27.8	73.7	7.64
5/31/2012 14:35	12.9	134	2	7.02	-22.6	59.5	6.29
5/31/2012 14:42	11.81	110	3	6.82	-11.4	32.3	3.49
5/31/2012 14:46	10.73	133	4	6.63	-0.5	2.4	0.27
5/31/2012 14:49	9.63	221	4.5	6.63	-0.9	1.1	0.13
5/31/2012 14:52	8.47	399	5.3	6.74	-7.1	0.1	0.01
6/12/2012 16:01	17.35	129	0	7.32	-39.1	102.2	9.8
6/12/2012 16:04	14.27	148	1	7.27	-36	115.1	11.79
6/12/2012 16:10	12.53	125	2	7.06	-23.9	73.7	7.84
6/12/2012 16:15	11.95	114	3	6.83	-11.1	31.2	3.36
6/12/2012 16:18	11.51	121	4	6.7	-3.7	7.2	0.78
6/12/2012 16:20	10.57	175	4.5	6.55	4.6	2.1	0.23
6/12/2012 16:22	8.84	445	5.5	6.65	-1.2	0.8	0.09
6/26/2012 9:29	13.74	115	0	7.18	-31.1	69.4	7.19
6/26/2012 9:31	13.55	119	1	7.1	-26.3	67.5	7.03
6/26/2012 9:35	13.48	118	2	7.06	-24.1	65	6.77
6/26/2012 9:38	13.31	123	3	6.98	-19.8	58.7	6.14
6/26/2012 9:46	12.43	125	4	6.81	-9.8	4.6	0.49
6/26/2012 9:50	10.69	205	4.5	6.7	-3.4	0.9	0.1
6/26/2012 9:51	9.65	361	5.3	6.76	-6.9	1.1	0.13
7/11/2012 9:51	19.01	162	0	8.26	-95.9	155.2	14.39
7/11/2012 9:55	17.14	169	1	8.27	-95.9	166	15.99

7/11/2012 10:02	14.86	141	2	7.71	-63.3	107.9	10.91
7/11/2012 10:07	13.52	130	3	7.01	-23.2	7.7	0.81
7/11/2012 10:12	12.05	169	4	6.78	-9.6	2.5	0.27
7/11/2012 16:05	10.78	282	4.5	6.99	-21.9	13.8	1.53
7/11/2012 10:16	10.01	423	5	6.81	-11.5	1.4	0.16
7/24/2012 9:32	16.22	123	0	7.24	-36.7	62.1	6.1
7/24/2012 9:34	16.08	125	1	7.12	-30.2	60.1	5.92
7/24/2012 9:40	15.77	128	2	6.99	-22.4	42.3	4.19
7/24/2012 9:44	15.11	133	3	6.81	-12.1	6.5	0.65
7/24/2012 9:50	12.07	192	4	6.72	-7.2	1.4	0.15
7/24/2012 9:52	11.13	279	4.5	6.73	-8.1	0.5	0.06
7/24/2012 9:55	10.21	485	5	6.89	-16.9	0.2	0.02
7/24/2012 9:56	9.74	590	5.5	6.88	-16.2	-0.1	0
8/7/2012 9:27	21.38	170	0	8.01	-82.4	111.3	9.85
8/7/2012 9:31	20.56	174	1	7.77	-67.9	137.8	12.38
8/7/2012 9:38	17.4	158	2	6.95	-20.4	7.7	0.74
8/7/2012 9:42	14.63	156	3	6.76	-9.2	2.1	0.21
8/7/2012 9:44	12.28	222	4	6.67	-4.4	1.2	0.13
8/7/2012 9:45	11.07	340	4.5	6.65	-3.4	0.9	0.09
8/7/2012 9:48	9.98	567	5.4	6.78	-10.8	0.3	0.04
8/22/2012 15:02	21.64	187	0	7.5	-52.5	58.7	5.17
8/22/2012 15:04	20.42	185	1	7.36	-44.4	52.8	4.76
8/22/2012 15:08	19.28	181	2	7.12	-30.1	11.5	1.06
8/22/2012 15:09	14.3	182	3	6.79	-10.9	3.1	0.31
8/22/2012 15:10	12.18	268	4	6.63	-2	1.4	0.15
8/22/2012 15:12	11.12	389	4.5	6.68	-5.3	1	0.11
8/22/2012 15:13	10.44	568	5.3	6.69	-5.4	0.7	0.08
9/12/2012 15:49	19.74	183	0	7.17	-33.2	23.5	2.15
9/12/2012 15:51	16.79	180	1	7.03	-24.9	22.3	2.17
9/12/2012 15:54	16.38	179	2	6.9	-17.2	4.1	0.41
9/12/2012 15:55	15.71	182	3	6.77	-10	2	0.2
9/12/2012 15:57	12.4	298	4	6.57	1.5	1.2	0.12
9/12/2012 15:59	11.17	440	4.5	6.67	-4.3	0.9	0.1
9/12/2012 16:00	10.55	586	5	6.69	-5.9	0.6	0.07
9/25/2012 10:10	16.03	189	0.5	8.07	-86.6	68.2	6.72
9/25/2012 10:12	16.01	187	1	7.65	-62.6	65.9	6.5
9/25/2012 10:19	15.71	190	2	7.01	-25.9	3.9	0.39
9/25/2012 10:21	15.49	193	3	6.92	-20.3	2.6	0.26
9/25/2012 10:23	12.88	304	4	6.63	-3.9	1.2	0.13
9/25/2012 10:24	11.73	407	4.5	6.64	-4.7	0.9	0.09
9/25/2012 10:26	10.83	603	5.4	6.7	-8.5	0.5	0.05

10/9/2012 15:39	14.91	187	0	7.47	-55.8	123.7	12.49
10/9/2012 15:42	13.16	191	1	7.2	-40	68.9	7.23
10/9/2012 15:45	12.99	191	2	6.97	-26.5	26.1	2.75
10/9/2012 15:49	12.91	192	3	6.81	-17.6	5.9	0.63
10/9/2012 15:51	12.8	198	4	6.72	-12.3	3	0.32
10/9/2012 15:53	11.68	455	4.5	6.59	-4.8	1.3	0.14
10/9/2012 15:55	10.93	709	5.2	6.69	-10.5	0.9	0.1
11/1/2012 14:32	12.86	69	0	8.06	-90.2	71.2	7.53
11/1/2012 14:33	12.61	70	1	7.71	-69.9	73.7	7.84
11/1/2012 14:36	12.39	72	2	7.33	-48.5	62.7	6.69
11/1/2012 14:39	11.02	115	3	6.92	-25	27.8	3.07
11/1/2012 14:42	9.63	139	4	6.79	-17.6	5.5	0.62
11/1/2012 14:43	9.58	144	4.5	6.74	-14.9	2.4	0.27
11/1/2012 14:45	9.57	175	5	6.7	-12.5	2.3	0.26
11/1/2012 14:46	9.7	326	5.5	6.54	-3.4	1	0.12

APPENDIX B: PHYTOPLANKTON DATA

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SCRIBER LAKE PHYTOPLANKTON				
CLIENT: City of Lynnwood/Tetratech-Seattle		**SAMPLE STATUS: LUGOL'S PRESERVED**		
DATE: 9/22/2011		**NOTE: small detrital matter conspic**		
STATION: Scriber Lake				
Comp (Surf+2M)				
Taxon	**Cells(Col)/ml**	**u3/cell**	**µ3/ml**	**Comments**
Cyanophyta				
+ Oscillatoriales	1.00	9,574	9,574	solitary fil<7um wide;sheath not evid
Taxon Subtotal	**1**		**9,574**	
Chlorophyta				
Oocystis sp.	10.00	1,013	10,132	
Quadrigula sp.	8.00	188	1,507	
nannoplankton unicell(sph)	18.00	7,235	130,222	cells>20um
nannoplankton unicell(sph)	170.00	1,150	195,460	dense cell contents
colonial nannoplankton(sph)	8.00	180	1,436	
Taxon Subtotal	**214**		**338,757**	
Chrysophyta				
Chrysophyta (non-diatoms)				
chrysophyte (unicell)	33.00	1,055	34,816	
chrysophyte (unicell)	264.00	729	192,584	flagel ellip cell
chrysophyte (unicell)	242.00	1,150	278,243	cell<15um
chrysophyte (unicell)	110.00	268	29,474	cell<10um
Bacillariophyceae				
Fragilaria sp.	10.00	468	4,680	
Taxon Subtotal	**659**		**539,797**	
Cryptophyta				
Cryptomonas sp.	33.00	2,000	66,006	
Cryptomonas sp.	5.00	5,935	29,673	
Rhodomonas sp.	110.00	175	19,273	
cryptomonad	3,850.00	984	3,789,902	
Taxon Subtotal	**3998**		**3,904,854**	
Euglenophyta				
Cryptoglena sp.	33.00	1,327	43,779	
Euglena sp.	3.00	2,653	7,960	
Trachelomonas sp. (ell)	26.00	12,309	320,029	
Trachelomonas sp. (sph)	10.00	4,187	41,867	
Trachelomonas sp. (sph)	94.00	2,571	241,687	
Taxon Subtotal	**166**		**655,322**	
Pyrrhophyta				
Other				
				um3/ml
Total Number/ml		**5038**	**Total Volume**	**5,448,304**
% Cyanophyta		**0.02**	% Cyanophyta	**0.18**
% Chlorophyta		**4.25**	% Chlorophyta	**6.22**
% Chrysophyta		**13.08**	% Chrysophyta	**9.91**
% Cryptophyta		**79.36**	% Cryptophyta	**71.67**
% Euglenophyta		**3.29**	% Euglenophyta	**12.03**
% Pyrrhophyta		**0.00**	% Pyrrhophyta	**0.00**
% Other		**0.00**	% Other	**0.00**
Note: *=colony/ml/+=fil/ml				

SCRIBER LAKE PHYTOPLANKTON				
CLIENT: City of Lynnwood/Tetratech-Seattle		**SAMPLE STATUS: LUGOL'S PRESERVED**		
DATE: 10/13/2011		**NOTE: small detrital matter conspic**		
STATION: Scriber Lake				
Comp (Surf+2M)				
Taxon	**Cells(Col)/ml**	**u3/cell**	**µ3/ml**	**Comments**
Cyanophyta				
Anphanothece sp.	50.00	3	134	cells<2um;cell sheaths obscure
Oscillatoriales: Pseudoanabaenaceae	1.00	924	924	thin fil<3um wide;no sheath
Taxon Subtotal	**51**		**1,058**	
Chlorophyta				
Oocystis sp.	6.00	1,013	6,079	
nannoplankton unicell(sph)	10.00	7,235	72,346	cells>20um
nannoplankton unicell(sph)	88.00	1,150	101,179	dense cell contents
Taxon Subtotal	**104**		**179,604**	
Chrysophyta				
Chrysophyta (non-diatoms)				
chrysophyte (unicell)	2.00	4,187	8,373	cell>20um
chrysophyte (unicell)	22.00	1,150	25,295	cell<15um
Bacillariophyceae				
Taxon Subtotal	**24**		**33,668**	
Cryptophyta				
Cryptomonas sp.	209.00	1,857	388,178	
Cryptomonas sp.	6.00	7,599	45,593	
Rhodomonas sp.	22.00	175	3,855	
small cryptomonad	66.00	565	37,303	
cryptomonad	55.00	984	54,141	
Taxon Subtotal	**358**		**529,070**	
Euglenophyta				
Cryptoglena sp.	10.00	1,758	17,584	
Phacus sp.	1.00	2,638	2,638	
Trachelomonas sp. (ell)	3.00	12,309	36,926	
Trachelomonas sp. (ell)	2.00	8,440	16,881	
Trachelomonas sp. (sph)	8.00	9,198	73,585	
Trachelomonas sp. (sph)	4.00	4,187	16,747	
Trachelomonas sp. (sph)	40.00	2,571	102,845	
Taxon Subtotal	**68**		**267,206**	
Pyrrhophyta				
Other				
undet unicell species	3.00	18,463	55,390	dense obovate cell<45um
Taxon Subtotal	**3**		**55,390**	
				um3/ml
Total Number/ml		**608**	**Total Volume**	**1,065,995**
% Cyanophyta		**8.39**	% Cyanophyta	**0.10**
% Chlorophyta		**17.11**	% Chlorophyta	**16.85**
% Chrysophyta		**3.95**	% Chrysophyta	**3.16**
% Cryptophyta		**58.88**	% Cryptophyta	**49.63**
% Euglenophyta		**11.18**	% Euglenophyta	**25.07**
% Pyrrhophyta		**0.00**	% Pyrrhophyta	**0.00**
% Other		**0.49**	% Other	**5.20**
Note: *=colony/ml/+=fil/ml				

SCRIBER LAKE PHYTOPLANKTON				
CLIENT: City of Lynnwood/Tetratech-Seattle		**SAMPLE STATUS: LUGOL'S PRESERVED**		
DATE: 11/10/2011		**NOTE: small detrital matter conspic**		
STATION: Scriber Lake				
Comp (Surf+2M)				
Taxon	**Cells(Col)/ml**	**u3/cell**	**µ3/ml**	**Comments**
Cyanophyta				
)scillatoriales: Pseudoanabaenaceae	3.00	1,188	3,565	thin fil<3um wide;no sheath
Taxon Subtotal	**3**		**3,565**	
Chlorophyta				
* *Oocystis sp.*	3.00	2,355	7,065	small colony<20um
Oocystis sp.	8.00	359	2,872	
nannoplankton unicell(sph)	1.00	5,572	5,572	cells>20um
nannoplankton unicell(sph)	12.00	1,150	13,797	dense cell contents
Taxon Subtotal	**24**		**29,307**	
Chrysophyta				
Chrysophyta (non-diatoms)				
chrysophyte (unicell)	88.00	1,150	101,179	cell<15um
chrysophyte (unicell)	55.00	268	14,737	cell<10um
Bacillariophyceae				
Navicula sp.	1.00	330	330	
Nitzschia sp.	2.00	580	1,161	
Synedra cyclopum	1.00	435	435	
Taxon Subtotal	**147**		**117,842**	
Cryptophyta				
Cryptomonas sp.	475.00	2,000	950,086	
Cryptomonas sp.	33.00	5,935	195,842	
Rhodomonas sp.	22.00	175	3,855	
small cryptomonad	44.00	565	24,869	
cryptomonad	55.00	984	54,141	
Taxon Subtotal	**629**		**1,228,792**	
Euglenophyta				
Cryptoglena sp.	1.00	1,256	1,256	
Euglena sp.	3.00	2,872	8,616	
Phacus sp.	3.00	2,638	7,913	
Trachelomonas sp. (ell)	3.00	16,412	49,235	spiny cellwall
Trachelomonas sp. (ell)	1.00	8,440	8,440	
Trachelomonas sp. (sph)	2.00	9,198	18,396	
Trachelomonas sp. (sph)	4.00	4,187	16,747	
Trachelomonas sp. (sph)	30.00	2,571	77,134	
Taxon Subtotal	**47**		**187,737**	
Pyrrhophyta				
Other				
undet unicell species	1.00	11,488	11,488	dense sph cell<30um
Taxon Subtotal	**1**		**11,488**	
				um3/ml
Total Number/ml		**851**	**Total Volume**	**1,578,731**
% Cyanophyta		**0.35**	% Cyanophyta	**0.23**
% Chlorophyta		**2.82**	% Chlorophyta	**1.86**
% Chrysophyta		**17.27**	% Chrysophyta	**7.46**
% Cryptophyta		**73.91**	% Cryptophyta	**77.83**
% Euglenophyta		**5.52**	% Euglenophyta	**11.89**
% Pyrrhophyta		**0.00**	% Pyrrhophyta	**0.00**
% Other		**0.12**	% Other	**0.73**
Note: *=colony/ml/+=fil/ml				

SCRIBER LAKE PHYTOPLANKTON				
CLIENT: City of Lynnwood/Tetratech-Seattle		**SAMPLE STATUS: LUGOL'S PRESERVED**		
DATE: 2/16/2012		**NOTE: small detrital matter conspic**		
STATION: Scriber Lake Comp				
Taxon	**Cells(Col)/ml**	**u3/cell**	**µ3/ml**	**Comments**
Cyanophyta				
Oscillatoriales: Pseudoanabaenaceae	12.00	858	10,299	thin fil<3um wide;no sheath
Taxon Subtotal	**12**		**10,299**	
Chlorophyta				
Ankistrodesmus falcatus	1.00	554	554	
Oocystis sp.	8.00	1,013	8,105	
nannoplankton unicell(sph)	5.00	523	2,617	dense cell contents
nannoplankton unicell(sph)	3.00	4,187	12,560	cells>20um
nannoplankton unicell(sph)	10.00	1,766	17,663	dense cell contents
Taxon Subtotal	**27**		**41,499**	
Chrysophyta				
Chrysophyta (non-diatoms)				
chrysophyte (unicell)	4.00	2,051	8,206	flagel ellip cell
chrysophyte (unicell)	3.00	4,187	12,560	cell>20um
chrysophyte (unicell)	77.00	1,150	88,532	cell<15um
chrysophyte (unicell)	77.00	268	20,632	cell<10um
Bacillariophyceae				
Gomphonema sp.	1.00	945	945	
Synedra cyclopum	1.00	1,099	1,099	
Synedra sp.	1.00	1,741	1,741	cells>150um length
pennate diatom	1.00	896	896	naviculoid cell
Taxon Subtotal	**165**		**134,610**	
Cryptophyta				
Cryptomonas sp.	8.00	1,572	12,573	
Cryptomonas spp.	1.00	2,462	2,462	
Cryptomonas sp.	1.00	13,716	13,716	large cell
Rhodomonas sp.	22.00	175	3,855	
cryptomonad	4.00	984	3,938	
Taxon Subtotal	**36**		**36,542**	
Euglenophyta				
Pyrrhophyta				
dinoflagellate	16.00	12,811	204,979	
small dinoflagellate	1.00	2,261	2,261	
Taxon Subtotal	**17**		**207,240**	
Other				
				um3/ml
Total Number/ml		**257**	**Total Volume**	**430,190**
% Cyanophyta		**4.67**	% Cyanophyta	**2.39**
% Chlorophyta		**10.51**	% Chlorophyta	**9.65**
% Chrysophyta		**64.20**	% Chrysophyta	**31.29**
% Cryptophyta		**14.01**	% Cryptophyta	**8.49**
% Euglenophyta		**0.00**	% Euglenophyta	**0.00**
% Pyrrhophyta		**6.61**	% Pyrrhophyta	**48.17**
% Other		**0.00**	% Other	**0.00**
Note: *=colony/ml/+=fil/ml				

SCRIBER LAKE PHYTOPLANKTON				
CLIENT: City of Lynnwood/Tetratech-Seattle		**SAMPLE STATUS: LUGOL'S PRESERVED**		
DATE: 3/15/2012		**NOTE: small detrital matter conspic**		
STATION: Scriber Lake				
Comp				
Taxon	**Cells(Col)/ml**	**u3/cell**	**µ3/ml**	**Comments**
Cyanophyta				
Oscillatoriales: Pseudoanabaenaceae	20.00	1,320	26,407	thin fil<3um wide;no sheath
+ Oscillatoriales	1.00	3,298	3,298	thin fil<5um wide;cyl cells;sheath not evid
* colonial Cyanophyta	1.00	153,860	153,860	disinteg col<70um diam;tiny ellip cells<3um
Taxon Subtotal	**22**		**183,566**	
Chlorophyta				
Ankistrodesmus falcatus	3.00	97	291	
undetermined filamentous green	14.00	342	4,787	
nannoplankton unicell(sph)	1.00	4,187	4,187	cells>20um
nannoplankton unicell(sph)	8.00	1,766	14,130	dense cell contents
Taxon Subtotal	**26**		**23,395**	
Chrysophyta				
Chrysophyta (non-diatoms)				
chrysophyte (unicell)	16.00	1,055	16,881	flagellate w/basal thread;disrupted Synura?
chrysophyte (unicell)	1.00	7,235	7,235	cell>20um
chrysophyte (unicell)	22.00	1,150	25,295	cell<15um
chrysophyte (unicell)	66.00	268	17,684	cell<10um
Bacillariophyceae				
Eunotia sp.	2.00	4,116	8,232	
Gomphonema sp.	3.00	1,890	5,670	
Melosira sp.	1.00	2,939	2,939	
Synedra sp.	1.00	3,297	3,297	cells>150um length
pennate diatom	3.00	352	1,055	naviculoid cell
Taxon Subtotal	**115**		**88,288**	
Cryptophyta				
Cryptomonas sp.	1.00	1,572	1,572	
Cryptomonas sp.	2.00	5,935	11,869	
Rhodomonas sp.	10.00	175	1,752	
small cryptomonad	22.00	565	12,434	
cryptomonad	12.00	984	11,813	
Taxon Subtotal	**47**		**39,440**	
Euglenophyta				
Pyrrhophyta				
dinoflagellate	2.00	10,550	21,101	
small dinoflagellate	2.00	2,261	4,522	
Taxon Subtotal	**4**		**25,622**	
Other				
				um3/ml
Total Number/ml		**214**	**Total Volume**	**360,310**
% Cyanophyta		**10.28**	% Cyanophyta	**50.95**
% Chlorophyta		**12.15**	% Chlorophyta	**6.49**
% Chrysophyta		**53.74**	% Chrysophyta	**24.50**
% Cryptophyta		**21.96**	% Cryptophyta	**10.95**
% Euglenophyta		**0.00**	% Euglenophyta	**0.00**
% Pyrrhophyta		**1.87**	% Pyrrhophyta	**7.11**
% Other		**0.00**	% Other	**0.00**
Note: *=colony/ml/+=fil/ml				

SCRIBER LAKE PHYTOPLANKTON				
CLIENT: City of Lynnwood/Tetratech-Seattle		**SAMPLE STATUS: LUGOL'S PRESERVED**		
DATE: 4/12/2012		**NOTE:**		
STATION: Scriber Lake				
Comp (Surf+2M)				
Taxon	**Cells(Col)/ml**	**u3/cell**	**µ3/ml**	**Comments**
Cyanophyta				
scillatoriales: Pseudoanabaenaceae	3.00	330	990	thin fil<3um wide;diffuse cells;sheath not evi
scillatoriales: Pseudoanabaenaceae	1.00	1,346	1,346	thin fil<4um wide;cyl cells;sheath not evid
Taxon Subtotal	**4**		**2,337**	
Chlorophyta				
Ankistrodesmus falcatus	1.00	171	171	
Oocystis sp.	4.00	1,013	4,053	
Quadrigula sp.	4.00	188	754	
nannoplankton unicell(sph)	2.00	1,436	2,872	
nannoplankton unicell(sph)	36.00	2,144	77,169	dense cell contents;flagel?
colonial nannoplankton(sph)	48.00	113	5,426	deterior cells conn by fine fibrils
colonial nannoplankton(sph)	4.00	523	2,093	cells>10um
Taxon Subtotal	**99**		**92,537**	
Chrysophyta				
Chrysophyta (non-diatoms)				
Dinobryon sp.	100.00	916	91,583	
Mallomonas sp.	16.00	2,257	36,106	
chrysophyte (unicell)	10.00	170	1,701	flagel clavate cell;deterior
chrysophyte (unicell)	8.00	1,055	8,440	flagel w/basal thread;disrupted Synura?
chrysophyte (unicell)	3.00	4,605	13,816	cell>20um
chrysophyte (unicell)	220.00	1,436	315,926	cell<15um
chrysophyte (unicell)	220.00	268	58,948	cell<10um
Bacillariophyceae				
Eunotia sp.	3.00	4,116	12,348	
Gomphonema sp.	2.00	2,100	4,200	
Navicula sp.	1.00	791	791	
Nitzschia sp.	1.00	665	665	
Synedra sp.	26.00	151	3,929	
Synedra sp.	8.00	212	1,692	
Synedra sp.	10.00	337	3,368	
Synedra sp.	1.00	2,473	2,473	cells>150um length
pennate diatom	2.00	879	1,758	naviculoid cell
Taxon Subtotal	**631**		**557,745**	
Cryptophyta				
Cryptomonas spp.	66.00	1,714	113,153	
Cryptomonas spp.	11.00	5,935	65,281	
tomonads(include Rhodomonas sp.)	100.00	175	17,521	
small cryptomonads	33.00	452	14,921	
cryptomonads	72.00	984	70,876	
Taxon Subtotal	**282**		**281,752**	
Euglenophyta				
Euglena sp.	1.00	824,250	824,250	large cell>400um length
Euglena sp.	2.00	4,308	8,616	
Trachelomonas sp. (sph)	2.00	4,187	8,373	
Taxon Subtotal	**5**		**841,239**	
Pyrrhophyta				
dinoflagellate	5.00	9,232	46,158	
Taxon Subtotal	**5**		**46,158**	
Other				
				um3/ml
Total Number/ml		**1026**	**Total Volume**	**1,821,768**
% Cyanophyta		**0.39**	% Cyanophyta	**0.13**
% Chlorophyta		**9.65**	% Chlorophyta	**5.08**
% Chrysophyta		**61.50**	% Chrysophyta	**30.62**
% Cryptophyta		**27.49**	% Cryptophyta	**15.47**
% Euglenophyta		**0.49**	% Euglenophyta	**46.18**
% Pyrrhophyta		**0.49**	% Pyrrhophyta	**2.53**
% Other		**0.00**	% Other	**0.00**

SCRIBER LAKE PHYTOPLANKTON				
CLIENT: City of Lynnwood/Tetratech-Seattle		**SAMPLE STATUS: LUGOL'S PRESERVED**		
DATE: 4/25/2012		**NOTE:**		
STATION: Scriber Lake				
Comp (Surf+2M)				
Taxon	**Cells(Col)/ml**	**u3/cell**	**µ3/ml**	**Comments**
Cyanophyta				
)scillatoriales: Pseudoanabaenaceae	5.00	962	4,808	thin fil<4um wide;cyl cells;sheath not evid
)scillatoriales: Pseudoanabaenaceae	1.00	4,255	4,255	thin fil<5um wide;cyl cells;sheath not evid
Taxon Subtotal	**6**		**9,063**	
Chlorophyta				
Ankistrodesmus falcatus	5.00	114	570	
Oocystis sp.	4.00	785	3,140	
nannoplankton unicell(sph)	20.00	1,436	28,721	
colonial nannoplankton(sph)	40.00	113	4,522	deterior cells conn by fine fibrils
Taxon Subtotal	**69**		**36,952**	
Chrysophyta				
Chrysophyta (non-diatoms)				
Dinobryon divergens	25.00	848	21,195	
Dinobryon sociale	60.00	785	47,100	
Mallomonas sp.	12.00	3,297	39,564	
Mallomonas sp.	12.00	2,051	24,618	
Synura sp.	750.00	2,051	1,538,600	disrupted colonies
chrysophyte (unicell)	22.00	144	3,166	flagel clavate cell;deterior
chrysophyte (unicell)	22.00	7,235	159,160	cell>20um
chrysophyte (unicell)	33.00	1,436	47,389	cell<15um
chrysophyte (unicell)	55.00	268	14,737	cell<10um
Bacillariophyceae				
Cyclotella sp.	4.00	1,608	6,431	
Diatoma sp.	20.00	1,920	38,400	
Gomphonema sp.	3.00	1,680	5,040	
Synedra sp.	16.00	169	2,708	
Synedra sp.	8.00	212	1,692	
Synedra sp.	8.00	337	2,694	
Synedra sp.	10.00	1,178	11,775	cells>150um length
pennate diatom	2.00	2,303	4,605	naviculoid cell
pennate diatom	2.00	1,436	2,872	naviculoid cell
Taxon Subtotal	**1064**		**1,971,747**	
Cryptophyta				
Cryptomonas spp.	440.00	1,714	754,354	
Cryptomonas sp.	44.00	5,935	261,122	
:ryptomonads(inc. Rhodomonas sp.)	220.00	175	38,547	
small cryptomonads	66.00	452	29,843	
cryptomonads	100.00	984	98,439	
Taxon Subtotal	**870**		**1,182,304**	
Euglenophyta				
Euglena sp.	3.00	3,231	9,693	
Trachelomonas sp. (ell)	1.00	25,409	25,409	
Trachelomonas sp. (sph)	1.00	7,235	7,235	
Trachelomonas sp. (sph)	7.00	4,187	29,307	
Taxon Subtotal	**12**		**71,643**	
Pyrrhophyta				
dinoflagellate	26.00	9,232	240,022	thecal plates obscure
Peridinium inconspicuum	16.00	2,261	36,173	thecal plates obscure
Taxon Subtotal	**42**		**276,194**	
Other				
undet unicell species	1.00	21,101	21,101	dense obovate cell<45um
Taxon Subtotal	**1**		**21,101**	
				um3/ml
Total Number/ml		**2064**	**Total Volume**	**3,569,005**
% Cyanophyta		**0.29**	% Cyanophyta	**0.25**
% Chlorophyta		**3.34**	% Chlorophyta	**1.04**
% Chrysophyta		**51.55**	% Chrysophyta	**55.25**
% Cryptophyta		**42.15**	% Cryptophyta	**33.13**
% Euglenophyta		**0.58**	% Euglenophyta	**2.01**
% Pyrrhophyta		**2.03**	% Pyrrhophyta	**7.74**
% Other		**0.05**	% Other	**0.59**
Note: *=colony/ml/+=fil/ml				

SCRIBER LAKE PHYTOPLANKTON				
CLIENT: City of Lynnwood/Tetratech-Seattle		**SAMPLE STATUS: LUGOL'S PRESERVED**		
DATE: 5/9/2012		**NOTE:**		
STATION: Scriber Lake				
Comp (Surf+2M)				
Taxon	**Cells(Col)/ml**	**u3/cell**	**µ3/ml**	**Comments**
Cyanophyta				
+ Oscillatoriales: Pseudoanabaenaceae	2.00	1,386	2,773	thin fil<3um wide;diffuse cells;sheath not evid
Taxon Subtotal	**2**		**2,773**	
Chlorophyta				
Ankistrodesmus falcatus	5.00	188	940	
Oocystis sp.	3.00	785	2,355	unicells
nannoplankton unicell(sph)	33.00	1,436	47,389	
nannoplankton unicell(sph)	88.00	4,187	368,427	cells>20um
colonial nannoplankton(sph)	4.00	1,436	5,744	cells>14um
Taxon Subtotal	**133**		**424,855**	
Chrysophyta				
Chrysophyta (non-diatoms)				
Dinobryon sp.	15.00	449	6,731	
Mallomonas sp.	24.00	3,297	79,128	
Mallomonas sp.	30.00	2,051	61,544	
chrysophyte (unicell)	33.00	144	4,749	flagel clavate cell;deterior
chrysophyte (unicell)	10.00	7,235	72,346	cell>20um
chrysophyte (unicell)	550.00	1,436	789,815	cell<15um
chrysophyte (unicell)	330.00	268	88,422	cell<10um
colonial chrysophyte	16.00	628	10,048	
Bacillariophyceae				
Gomphonema sp.	1.00	1,680	1,680	
Navicula sp.	2.00	183	366	
Navicula sp.	3.00	615	1,846	
Nitzschia sp.	1.00	327	327	
Synedra cyclopum	4.00	1,319	5,275	
Synedra ulna	7.00	2,572	18,002	
Synedra sp.	12.00	169	2,031	
Synedra sp.	6.00	212	1,269	
Synedra sp.	24.00	370	8,891	
Synedra sp.	3.00	1,079	3,238	cells>150um length
pennate diatom	4.00	1,436	5,744	naviculoid cell
Taxon Subtotal	**1075**		**1,161,453**	
Cryptophyta				
Cryptomonas spp.	515.00	2,000	1,030,093	
Cryptomonas spp.	220.00	5,935	1,305,612	
Cryptomonas spp.	11.00	13,716	150,871	large cell
ıall cryptomonads(inc. Rhodomonas spp.)	330.00	175	57,820	
cryptomonads	540.00	984	531,571	
Taxon Subtotal	**1616**		**3,075,966**	
Euglenophyta				
Trachelomonas sp. (ell)	1.00	7,837	7,837	
Trachelomonas sp. (sph)	6.00	4,187	25,120	
Taxon Subtotal	**7**		**32,957**	
Pyrrhophyta				
dinoflagellate	48.00	6,858	329,172	thecal plates obscure
dinoflagellate	2.00	14,318	28,637	thecate
Peridinium inconspicuum	24.00	2,261	54,259	
Taxon Subtotal	**74**		**412,068**	
Other				
				um3/ml
Total Number/ml		**2907**	**Total Volume**	**5,110,073**
% Cyanophyta		**0.07**	% Cyanophyta	**0.05**
% Chlorophyta		**4.58**	% Chlorophyta	**8.31**
% Chrysophyta		**36.98**	% Chrysophyta	**22.73**
% Cryptophyta		**55.59**	% Cryptophyta	**60.19**
% Euglenophyta		**0.24**	% Euglenophyta	**0.64**
% Pyrrhophyta		**2.55**	% Pyrrhophyta	**8.06**
% Other		**0.00**	% Other	**0.00**
Note: *=colony/ml/+=fil/ml				

SCRIBER LAKE PHYTOPLANKTON				
CLIENT: City of Lynnwood/Tetratech-Seattle		**SAMPLE STATUS: LUGOL'S PRESERVED**		
DATE: 5/31/2012		**NOTE:**		
STATION: Scriber Lake				
Comp (Surf+2M)				
Taxon	**Cells(Col)/ml**	**u3/cell**	**µ3/ml**	**Comments**
Cyanophyta				
Chlorophyta				
nannoplankton unicell(sph)	15.00	1,436	21,540	
colonial nannoplankton(sph)	12.00	150	1,805	
colonial nannoplankton(sph)	8.00	523	4,187	
Taxon Subtotal	**35**		**27,533**	
Chrysophyta				
Chrysophyta (non-diatoms)				
Dinobryon divergens	10.00	848	8,478	
Mallomonas sp.	2.00	3,062	6,123	
Mallomonas sp.	7.00	2,051	14,360	
chrysophyte (unicell)	66.00	144	9,499	flagel clavate cell;deterior
chrysophyte (unicell)	3.00	718	2,154	ellip cells<30um
chrysophyte (unicell)	10.00	9,198	91,981	cell>20um
chrysophyte (unicell)	44.00	1,436	63,185	cell<15um
chrysophyte (unicell)	200.00	268	53,589	cell<10um
Bacillariophyceae				
Navicula sp.	2.00	183	366	
Synedra sp.	2.00	169	338	
Taxon Subtotal	**346**		**250,074**	
Cryptophyta				
Cryptomonas spp.	290.00	2,000	580,052	
Cryptomonas spp.	270.00	5,935	1,602,342	
Cryptomonas spp.	30.00	13,716	411,466	large cell
mall cryptomonads(inc. Rhodomonas sp.)	55.00	175	9,637	
cryptomonads	352.00	984	346,505	
Taxon Subtotal	**997**		**2,950,002**	
Euglenophyta				
Trachelomonas sp. (sph)	11.00	4,187	46,053	
Taxon Subtotal	**11**		**46,053**	
Pyrrhophyta				
Other				
				um3/ml
Total Number/ml		**1389**	**Total Volume**	**3,273,662**
% Cyanophyta		**0.00**	% Cyanophyta	**0.00**
% Chlorophyta		**2.52**	% Chlorophyta	**0.84**
% Chrysophyta		**24.91**	% Chrysophyta	**7.64**
% Cryptophyta		**71.78**	% Cryptophyta	**90.11**
% Euglenophyta		**0.79**	% Euglenophyta	**1.41**
% Pyrrhophyta		**0.00**	% Pyrrhophyta	**0.00**
% Other		**0.00**	% Other	**0.00**
Note: *=colony/ml/+=fil/ml				

SCRIBER LAKE PHYTOPLANKTON				
CLIENT: City of Lynnwood/Tetratech-Seattle		**SAMPLE STATUS: LUGOL'S PRESERVED**		
DATE: 6/11/2012		**NOTE:**		
STATION: Scriber Lake				
Comp (Surf+2M)				
Taxon	**Cells(Col)/ml**	**u3/cell**	**µ3/ml**	**Comments**
Cyanophyta				
Chlorophyta				
nannoplankton unicell(sph)	220.00	1,436	315,926	
nannoplankton unicell(sph)	10.00	4,187	41,867	cells>20um
colonial nannoplankton(sph)	8.00	150	1,204	
Taxon Subtotal	**238**		**358,996**	
Chrysophyta				
Chrysophyta (non-diatoms)				
Mallomonas sp.	1.00	2,462	2,462	
chrysophyte (unicell)	55.00	144	7,915	flagel clavate cell;deterior
chrysophyte (unicell)	4.00	5,426	21,704	flagel obovoid cell;Ochromonas-like
chrysophyte (unicell)	4.00	5,572	22,290	cell>20um
chrysophyte (unicell)	77.00	1,436	110,574	cell<15um
chrysophyte (unicell)	220.00	268	58,948	cell<10um
Bacillariophyceae				
Navicula sp.	3.00	183	550	
Navicula sp.	1.00	2,198	2,198	
Synedra ulna	1.00	2,704	2,704	
Synedra ulna	1.00	4,579	4,579	
Synedra sp.	1.00	134	134	
Synedra sp.	4.00	179	716	
Synedra sp.	2.00	256	512	
Taxon Subtotal	**374**		**235,285**	
Cryptophyta				
Cryptomonas spp.	1,210.00	2,000	2,420,218	
Cryptomonas spp.	330.00	6,217	2,051,676	
Cryptomonas spp.	30.00	13,716	411,466	large cell
mall cryptomonads(inc. Rhodomonas sp.)	165.00	175	28,910	
cryptomonads	990.00	984	974,546	
Taxon Subtotal	**2725**		**5,886,815**	
Euglenophyta				
Trachelomonas sp. (sph)	40.00	3,590	143,582	
Taxon Subtotal	**40**		**143,582**	
Pyrrhophyta				
dinoflagellate	6.00	6,858	41,147	thecal plates obscure
Taxon Subtotal	**6**		**41,147**	
Other				
				um3/ml
Total Number/ml		**3383**	**Total Volume**	**6,665,825**
% Cyanophyta		**0.00**	% Cyanophyta	**0.00**
% Chlorophyta		**7.04**	% Chlorophyta	**5.39**
% Chrysophyta		**11.06**	% Chrysophyta	**3.53**
% Cryptophyta		**80.55**	% Cryptophyta	**88.31**
% Euglenophyta		**1.18**	% Euglenophyta	**2.15**
% Pyrrhophyta		**0.18**	% Pyrrhophyta	**0.62**
% Other		**0.00**	% Other	**0.00**
Note: *=colony/ml/+=fil/ml				

SCRIBER LAKE PHYTOPLANKTON				
CLIENT: City of Lynnwood/Tetratech-Seattle		**SAMPLE STATUS: LUGOL'S PRESERVED**		
DATE: 6/26/2012		**NOTE:**		
STATION: Scriber Lake				
Comp (Surf+2M)				
Taxon	**Cells(Col)/ml**	**u3/cell**	**µ3/ml**	**Comments**
Cyanophyta				
+ Oscillatoriales	9.00	11,284	101,558	solitary fil<7um wide;cyl cells;sheath not evid
Taxon Subtotal	**9**		**101,558**	
Chlorophyta				
nannoplankton unicell(sph)	33.00	1,436	47,389	
Taxon Subtotal	**33**		**47,389**	
Chrysophyta				
Chrysophyta (non-diatoms)				
Dinobryon sp.	25.00	449	11,219	
chrysophyte (unicell)	10.00	5,765	57,650	flagel obovoid cell;Ochromonas-like
chrysophyte (unicell)	20.00	9,198	183,962	cell>20um;assoc w/detritus
chrysophyte (unicell)	100.00	1,436	143,603	cell<15um
chrysophyte (unicell)	165.00	268	44,211	cell<10um
Bacillariophyceae				
Fragilaria crotonensis	10.00	975.00	9,750	
Navicula sp.	1.00	1,319	1,319	
Nitzschia sp.	1.00	419	419	
Synedra ulna	1.00	4,579	4,579	
Synedra sp.	1.00	370	370	
pennate diatom	1.00	290	290	naviculoid cell
Taxon Subtotal	**335**		**457,373**	
Cryptophyta				
Cryptomonas spp.	88.00	2,000	176,016	
Cryptomonas spp.	16.00	5,652	90,432	
mall cryptomonads(inc. Rhodomonas sp.)	77.00	175	13,491	
cryptomonads	44.00	984	43,313	
Taxon Subtotal	**225**		**323,252**	
Euglenophyta				
Trachelomonas sp. (sph)	4.00	3,590	14,358	
Taxon Subtotal	**4**		**14,358**	
Pyrrhophyta				
Other				
				um3/ml
Total Number/ml		**606**	**Total Volume**	**943,930**
% Cyanophyta		**1.49**	% Cyanophyta	**10.76**
% Chlorophyta		**5.45**	% Chlorophyta	**5.02**
% Chrysophyta		**55.28**	% Chrysophyta	**48.45**
% Cryptophyta		**37.13**	% Cryptophyta	**34.25**
% Euglenophyta		**0.66**	% Euglenophyta	**1.52**
% Pyrrhophyta		**0.00**	% Pyrrhophyta	**0.00**
% Other		**0.00**	% Other	**0.00**
Note: *=colony/ml/+=fil/ml				

SCRIBER LAKE PHYTOPLANKTON				
CLIENT: City of Lynnwood/Tetratech-Seattle		**SAMPLE STATUS: LUGOL'S PRESERVED**		
DATE: 7/11/2012		**NOTE:**		
STATION: Scriber Lake				
Comp (Surf+2M)				
Taxon	**Cells(Col)/ml**	**u3/cell**	**µ3/ml**	**Comments**
Cyanophyta				
+ Oscillatoriales	2.00	11,968	23,936	solitary fil<7um wide;cyl cells w/aerotopes;sheath not evid
Taxon Subtotal	**2**		**23,936**	
Chlorophyta				
Closterium sp.	1.00	462	462	slender lunate cell<150um
nannoplankton unicell(sph)	100.00	1,436	143,603	
nannoplankton unicell(sph)	10.00	4,187	41,867	cells>20um
colonial nannoplankton(sph)	16.00	150	2,407	
Taxon Subtotal	**127**		**188,339**	
Chrysophyta				
Chrysophyta (non-diatoms)				
Dinobryon divergens	50.00	756	37,811	
Dinobryon sociale	50.00	733	36,633	
Dinobryon sp.	30.00	229	6,869	
chrysophyte (unicell)	440.00	6,104	2,685,830	flagel obovoid cell;Ochromonas-like
chrysophyte (unicell)	440.00	9,198	4,047,167	cell>20um;assoc w/detritus
chrysophyte (unicell)	770.00	1,436	1,105,741	cell<15um
chrysophyte (unicell)	440.00	268	117,897	cell<10um
Bacillariophyceae				
Eunotia sp.	1.00	42,000	42,000	
Fragilaria sp.	10.00	720	7,200	
Navicula sp.	1.00	183	183	
Synedra ulna	1.00	2,704	2,704	
Synedra sp.	1.00	102	102	
Synedra sp.	2.00	256	512	
Synedra sp.	1.00	2,051	2,051	
Synedra sp.	1.00	981	981	cells>150um length
Taxon Subtotal	**2238**		**8,093,681**	
Cryptophyta				
Cryptomonas spp.	913.00	2,000	1,826,164	
Cryptomonas spp.	495.00	5,652	2,797,740	
Cryptomonas spp.	22.00	13,716	301,741	large cell
small cryptomonads(inc. Rhodomonas sp.)	220.00	175	38,547	
cryptomonads	110.00	984	108,283	
Taxon Subtotal	**1760**		**5,072,475**	
Euglenophyta				
Euglena oyxuris	2.00	95,519	191,038	large cell>150um length
Trachelomonas sp. (ell)	1.00	15,072	15,072	
Trachelomonas sp. (sph)	242.00	3,052	738,603	
euglenoid	1.00	1,641	1,641	
Taxon Subtotal	**246**		**946,354**	
Pyrrhophyta				
dinoflagellate	1.00	6,858	6,858	thecal plates obscure
Taxon Subtotal	**1**		**6,858**	
Other				
				um3/ml
Total Number/ml		**4374**	**Total Volun**	**14,331,643**
% Cyanophyta		**0.05**	% Cyanophyta	**0.17**
% Chlorophyta		**2.90**	% Chlorophyta	**1.31**
% Chrysophyta		**51.17**	% Chrysophyta	**56.47**
% Cryptophyta		**40.24**	% Cryptophyta	**35.39**
% Euglenophyta		**5.62**	% Euglenophy	**6.60**
% Pyrrhophyta		**0.02**	% Pyrrhophyta	**0.05**
% Other		**0.00**	% Other	**0.00**
Note: *=colony/ml/+=fil/ml				

SCRIBER LAKE PHYTOPLANKTON				
CLIENT: City of Lynnwood/Tetratech-Seattle		**SAMPLE STATUS: LUGOL'S PRESERVED**		
DATE: 7/25/2012		**NOTE:**		
STATION: Scriber Lake				
Comp (Surf+2M)				
Taxon	**Cells(Col)/ml**	**u3/cell**	**µ3/ml**	**Comments**
Cyanophyta				
+ Oscillatoriales	1.00	14,362	14,362	solitary fil<7um wide;cyl cells w/aerotopes;sheath not evid
Taxon Subtotal	**1**		**14,362**	
Chlorophyta				
Eudorina sp.	128.00	904	115,753	
* *Scenedesmus bijuga*	1.00	628	628	4-cell colony
nannoplankton unicell(sph)	100.00	1,436	143,603	
nannoplankton unicell(sph)	10.00	4,187	41,867	cells>20um
colonial nannoplankton(sph)	24.00	180	4,308	
Taxon Subtotal	**263**		**306,158**	
Chrysophyta				
Chrysophyta (non-diatoms)				
chrysophyte (unicell)	10.00	6,104	61,042	flagel obovoid cell;Ochromonas-like
chrysophyte (unicell)	8.00	9,198	73,585	cell>20um;assoc w/detritus
chrysophyte (unicell)	4,840.00	1,436	6,950,369	cell<15um
chrysophyte (unicell)	220.00	268	58,948	cell<10um
colonial chrysophyte	12.00	2,144	25,723	
colonial chrysophyte	64.00	628	40,192	
colonial chrysophyte	100.00	150	15,046	
Bacillariophyceae				
Cocconeis sp.	1.00	2,826	2,826	
Eunotia sp.	1.00	28,224	28,224	
Taxon Subtotal	**5256**		**7,255,954**	
Cryptophyta				
Cryptomonas spp.	187.00	2,000	374,034	
Cryptomonas spp.	38.00	5,652	214,776	
Cryptomonas spp.	1.00	13,716	13,716	large cell
small cryptomonads(inc. Rhodomonas sp.)	22.00	175	3,855	
cryptomonads	10.00	984	9,844	
Taxon Subtotal	**258**		**616,224**	
Euglenophyta				
Trachelomonas sp. (sph)	60.00	3,052	183,125	
Taxon Subtotal	**60**		**183,125**	
Pyrrhophyta				
dinoflagellate	2.00	6,858	13,716	thecal plates obscure
Taxon Subtotal	**2**		**13,716**	
Other				
				um3/ml
Total Number/ml		**5840**	**Total Volun**	**8,389,538**
% Cyanophyta		**0.02**	% Cyanophyta	**0.17**
% Chlorophyta		**4.50**	% Chlorophyta	**3.65**
% Chrysophyta		**90.00**	% Chrysophyta	**86.49**
% Cryptophyta		**4.42**	% Cryptophyta	**7.35**
% Euglenophyta		**1.03**	% Euglenophyt	**2.18**
% Pyrrhophyta		**0.03**	% Pyrrhophyta	**0.16**
% Other		**0.00**	% Other	**0.00**
Note: *=colony/ml/+=fil/ml				

SCRIBER LAKE PHYTOPLANKTON				
CLIENT: City of Lynnwood/Tetratech-Seattle		**SAMPLE STATUS: LUGOL'S PRESERVED**		
DATE: 8/7/2012		**NOTE:**		
STATION: Scriber Lake				
Comp (Surf+2M)				
Taxon	**Cells(Col)/ml**	**u3/cell**	**µ3/ml**	**Comments**
Cyanophyta				
+ Oscillatoriales: Pseudoanabaenaceae	1.00	6,731	6,731	thin fil<4um wide;cyl cells;sheath not evid
+ Oscillatoriales	490.00	10,258	5,026,606	sol fil<7um wide;cyl cells w/aerotopes;no sheath;Planktothrix-like
Taxon Subtotal	**491**		**5,033,338**	
Chlorophyta				
Closterium sp.	1.00	462	462	slender lunate cell<150um
nannoplankton unicell(sph)	44.00	382	16,786	
nannoplankton unicell(sph)	44.00	1,436	63,185	
nannoplankton unicell(sph)	22.00	5,572	122,594	cells>20um
colonial nannoplankton(sph)	80.00	113	9,043	
Taxon Subtotal	**191**		**212,071**	
Chrysophyta				
Chrysophyta (non-diatoms)				
chrysophyte (unicell)	6,050.00	1,436	8,687,961	cell<15um
chrysophyte (unicell)	200.00	268	53,589	cell<10um
Bacillariophyceae				
Eunotia sp.	1.00	18,816	18,816	
pennate diatom	12.00	840	10,080	linear chain of naviculoid cellsl
Taxon Subtotal	**6263**		**8,770,447**	
Cryptophyta				
Cryptomonas spp.	132.00	2,000	264,024	
Cryptomonas spp.	10.00	5,652	56,520	
small cryptomonads(inc. Rhodomonas sp.)	50.00	175	8,761	
cryptomonads	110.00	984	108,283	
Taxon Subtotal	**302**		**437,587**	
Euglenophyta				
Euglena sp.	1.00	5,385	5,385	
Euglena sp.	8.00	1,256	10,048	
Euglena sp.	12.00	12,309	147,706	
Trachelomonas sp. (ell)	1.00	11,321	11,321	
Trachelomonas sp. (sph)	319.00	3,052	973,614	
Taxon Subtotal	**341**		**1,148,073**	
Pyrrhophyta				
Other				
undet unicell species	10.00	39,773	397,733	dense obovate cell<60um
Taxon Subtotal	**10**		**397,733**	
				um3/ml
Total Number/ml		**7598**	**Total Volun**	**15,999,249**
% Cyanophyta		**6.46**	% Cyanophyta	**31.46**
% Chlorophyta		**2.51**	% Chlorophyta	**1.33**
% Chrysophyta		**82.43**	% Chrysophyta	**54.82**
% Cryptophyta		**3.97**	% Cryptophyta	**2.74**
% Euglenophyta		**4.49**	% Euglenophyt	**7.18**
% Pyrrhophyta		**0.00**	% Pyrrhophyta	**0.00**
% Other		**0.13**	% Other	**2.49**
Note: *=colony/ml/+=fil/ml				

SCRIBER LAKE PHYTOPLANKTON				
CLIENT: City of Lynnwood/Tetratech-Seattle		**SAMPLE STATUS: LUGOL'S PRESERVED**		
DATE: 8/20/2012		**NOTE:**		
STATION: Scriber Lake				
Comp (Surf+2M)				
Taxon	**Cells(Col)/ml**	**u3/cell**	**µ3/ml**	**Comments**
Cyanophyta				
+ Oscillatoriales: Pseudoanabaenaceae	110.00	673	74,045	thin fil<4um wide;cyl cells;sheath not evid
+ Oscillatoriales	815.00	13,678	11,147,440	sol fil<7um wide;cyl cells w/aerotopes;no sheath;Planktothrix-like
Taxon Subtotal	**925**		**11,221,485**	
Chlorophyta				
* *Botryococcus sp.*	1.00	8,206	8,206	small col<30um diam
Closterium sp.	3.00	578	1,734	slender lunate cell<150um
Staurastrum sp.	1.00	3,352.97	3,353	semi-cells w/long processes
nannoplankton unicell(sph)	220.00	904	198,950	
nannoplankton unicell(sph)	3.00	5,572	16,717	cells>20um
* colonial nannoplankton (ell)	1.00	8,206	8,206	compres quadrate cells
Taxon Subtotal	**229**		**237,167**	
Chrysophyta				
Chrysophyta (non-diatoms)				
Dinobryon cylindricum (tenta)	5.00	1,425	7,124	robust cell
Dinobryon divergens	5.00	756	3,781	
chrysophyte (unicell)	264.00	377	99,475	ellip cells<30um
chrysophyte (unicell)	55.00	7,235	397,901	cell>20um;assoc w/detritus
chrysophyte (unicell)	3,630.00	1,055	3,829,795	cell<15um
chrysophyte (unicell)	154.00	268	41,264	cell<10um
Bacillariophyceae				
Synedra ulna	4.00	2,308	9,232	
pennate diatom	12.00	840	10,080	linear chain of naviculoid cellsl
Taxon Subtotal	**4129**		**4,398,652**	
Cryptophyta				
Cryptomonas spp.	209.00	2,000	418,038	
Cryptomonas spp.	14.00	5,652	79,128	
small cryptomonads(inc. Rhodomonas sp.)	110.00	175	19,273	
cryptomonads	66.00	984	64,970	
Taxon Subtotal	**399**		**581,409**	
Euglenophyta				
Euglena oxyuris	7.00	84,906	594,339	large cell>150um length
Euglena sp.	28.00	8,206	229,764	
Lepocinclis sp.	33.00	2,110	69,633	
Phacus sp. (large)	1.00	19,694	19,694	
Phacus sp.	39.00	2,638	102,866	
Trachelomonas sp. (ell)	14.00	21,436	300,100	
Trachelomonas sp. (ell)	2.00	11,321	22,641	
Trachelomonas sp. (sph)	913.00	3,052	2,786,549	
Taxon Subtotal	**1037**		**4,125,587**	
Pyrrhophyta				
Other				
undet unicell species	44.00	36,591	1,610,025	dense obovate cell<60um
Taxon Subtotal	**44**		**1,610,025**	
				um3/ml
Total Number/ml		**6763**	**Total Volun**	**22,174,323**
% Cyanophyta		**13.68**	% Cyanophyta	**50.61**
% Chlorophyta		**3.39**	% Chlorophyta	**1.07**
% Chrysophyta		**61.05**	% Chrysophyta	**19.84**
% Cryptophyta		**5.90**	% Cryptophyta	**2.62**
% Euglenophyta		**15.33**	% Euglenophyt	**18.61**
% Pyrrhophyta		**0.00**	% Pyrrhophyta	**0.00**
% Other		**0.65**	% Other	**7.26**
Note: *=colony/ml/+=fil/ml				

SCRIBER LAKE PHYTOPLANKTON				
CLIENT: City of Lynnwood/Tetratech-Seattle		**SAMPLE STATUS: LUGOL'S PRESERVED**		
DATE: 9/12/2012		**NOTE: fine detrital matter**		
STATION: Scriber Lake				
Comp (Surf+2M)				
Taxon	**Cells(Col)/ml**	**u3/cell**	**µ3/ml**	**Comments**
Cyanophyta				
+ Oscillatoriales: Pseudoanabaenaceae	3.00	924	2,773	thin fil<3um wide;diffuse cells;sheath not evid
+ Oscillatoriales	6.00	8,378	50,266	sol fil<7um wide;cyl cells w/aerotopes;no sheath;Planktothrix-like
Taxon Subtotal	**9**		**53,039**	
Chlorophyta				
Closterium sp.	64.00	578	36,993	slender lunate cell<150um
Oocystis sp.	10.00	359	3,590	
* *Scenedesmus quadricauda*	5.00	256	1,282	4-cell colony
Schroederia/Ankyra spp. asmblg	2.00	176	352	
Staurastrum sp.	10.00	3,208.97	32,090	semi-cells w/long processes
nannoplankton unicell(sph)	200.00	904	180,864	
colonial nannoplankton(sph)	80.00	113	9,043	
colonial nannoplankton(sph)	16.00	382	6,104	
Taxon Subtotal	**387**		**270,318**	
Chrysophyta				
Chrysophyta (non-diatoms)				
Dinobryon divergens	200.00	569	113,877	
chrysophyte (unicell)	10.00	144	1,439	flagel clavate cell;deterior
chrysophyte (unicell)	100.00	339	33,912	ellip cells<30um
chrysophyte (unicell)	10.00	5,087	50,868	flagel ellip cell
chrysophyte (unicell)	4.00	7,235	28,938	cell>20um;assoc w/detritus
chrysophyte (unicell)	132.00	1,055	139,265	cell<15um
chrysophyte (unicell)	264.00	268	70,738	cell<10um
Bacillariophyceae				
Navicula sp.	1.00	615	615	
pennate diatom	1.00	1,005	1,005	naviculoid cell
pennate diatom	1.00	2,646	2,646	naviculoid cell
Taxon Subtotal	**723**		**443,304**	
Cryptophyta				
Cryptomonas spp.	44.00	2,000	88,008	
Cryptomonas spp.	2.00	5,652	11,304	
small cryptomonads(inc. Rhodomonas sp.)	44.00	175	7,709	
cryptomonads	22.00	984	21,657	
Taxon Subtotal	**112**		**128,678**	
Euglenophyta				
Euglena oxyuris	1.00	92,316	92,316	large cell>150um length
Euglena sp.	22.00	10,362	227,964	
Lepocinclis sp.	4.00	2,110	8,440	
Phacus sp. (large)	1.00	10,111	10,111	spirally twisted
Phacus sp.	4.00	2,638	10,550	
Trachelomonas sp. (ell)	24.00	21,436	514,458	
Trachelomonas sp. (ell)	4.00	13,129	52,518	spiny cellwall
Trachelomonas sp. (sph)	352.00	3,052	1,074,332	
Taxon Subtotal	**412**		**1,990,689**	
Pyrrhophyta				
Other				
undet unicell species	10.00	31,500	315,005	dense obovate cell<60um
Taxon Subtotal	**10**		**315,005**	
				um3/ml
Total Number/ml		**1653**	**Total Volum**	**3,201,033**
% Cyanophyta		**0.54**	% Cyanophyta	**1.66**
% Chlorophyta		**23.41**	% Chlorophyta	**8.44**
% Chrysophyta		**43.74**	% Chrysophyta	**13.85**
% Cryptophyta		**6.78**	% Cryptophyta	**4.02**
% Euglenophyta		**24.92**	% Euglenophyta	**62.19**
% Pyrrhophyta		**0.00**	% Pyrrhophyta	**0.00**
% Other		**0.60**	% Other	**9.84**
Note: *=colony/ml/+=fil/ml				

SCRIBER LAKE PHYTOPLANKTON				
CLIENT: City of Lynnwood/Tetratech-Seattle		**SAMPLE STATUS: LUGOL'S PRESERVED**		
DATE: 9/25/2012		**NOTE: fine detrital matter**		
STATION: Scriber Lake				
Comp (Surf+2M)				
Taxon	**Cells(Col)/ml**	**u3/cell**	**µ3/ml**	**Comments**
Cyanophyta				
+ Oscillatoriales: Pseudoanabaenaceae	1.00	2,773	2,773	thin fil<3um wide;diffuse cells;sheath not evid
Taxon Subtotal	**1**		**2,773**	
Chlorophyta				
Ankistrodesmus falcatus	10.00	114	1,140	
Closteriopsis sp.	6.00	1,308	7,850	cells>200um length
Closterium sp.	210.00	636	133,523	slender lunate cell<150um
* *Coelastrum sp.*	10.00	4,187	41,867	small colony<20um
Oocystis sp.	10.00	359	3,590	
* *Pediastrum sp.*	1.00	720	720	small colony<25um
* *Scenedesmus bijuga*	11.00	402	4,421	4-cell colony
* *Scenedesmus quadricauda*	44.00	256	11,283	4-cell colony
Schroederia/Ankyra spp. asmblg	10.00	176	1,758	
Staurastrum sp.	95.00	3,208.97	304,852	semi-cells w/long processes
undetermined desmid	1.00	3,096.97	3,097	
undetermined filamentous green	2.00	1,178	2,355	cells collapsed
nannoplankton unicell(sph)	220.00	382	83,932	
nannoplankton unicell(sph)	165.00	904	149,213	
nannoplankton unicell(sph)	1.00	11,488	11,488	cells>20um
colonial nannoplankton(sph)	44.00	113	4,974	
Taxon Subtotal	**840**		**766,063**	
Chrysophyta				
Chrysophyta (non-diatoms)				
Dinobryon divergens	330.00	636	210,003	
Rhizochrysis sp.	1.00	9,420	9,420	large cell
chrysophyte (unicell)	22.00	144	3,166	flagel clavate cell;deterior
chrysophyte (unicell)	22.00	5,572	122,594	cell>20um;assoc w/detritus
chrysophyte (unicell)	1,100.00	1,055	1,160,544	cell<15um
chrysophyte (unicell)	1,320.00	268	353,690	cell<10um
colonial chrysophyte	16.00	628	10,048	
Bacillariophyceae				
Fragilaria crotonensis	10.00	600.00	6,000	
Gomphonema constrictum	1.00	4,116	4,116	
Navicula sp.	4.00	615	2,462	
Synedra ulna	1.00	5,770	5,770	
Synedra ulna	1.00	4,121	4,121	
Synedra sp.	5.00	128	639	
Synedra sp.	2.00	236	471	
Synedra sp.	1.00	370	370	
Taxon Subtotal	**2836**		**1,893,415**	
Cryptophyta				
Cryptomonas spp.	440.00	2,000	880,079	
Cryptomonas spp.	44.00	5,652	248,688	
small cryptomonads(inc. Rhodomonas sp.)	55.00	175	9,637	
small cryptomonads	55.00	452	24,869	
cryptomonads	726.00	984	714,667	
Taxon Subtotal	**1320**		**1,877,940**	
Euglenophyta				
Euglena sp.	3.00	11,304	33,912	large cell>150um length
Euglena sp.	10.00	4,748	47,477	
Euglena sp.	77.00	11,304	870,408	
Lepocinclis sp.	10.00	2,110	21,101	
Phacus sp.	10.00	2,638	26,376	
Trachelomonas sp. (ell)	10.00	21,436	214,357	
Trachelomonas sp. (ell)	4.00	13,129	52,518	spiny cellwall
Trachelomonas sp. (sph)	473.00	3,052	1,443,634	
euglenoid	10.00	754	7,536	
Taxon Subtotal	**607**		**2,717,318**	
Pyrrhophyta				
Ceratium hirundinella	2.00	60,000	120,000	
Taxon Subtotal	**2**		**120,000**	
Other				
undet unicell species	20.00	31,500	630,010	dense obovate cell<60um
Taxon Subtotal	**20**		**630,010**	
				um3/ml
Total Number/ml		**5626**	**Total Volume**	**8,007,518**
% Cyanophyta		**0.02**	% Cyanophyta	**0.03**
% Chlorophyta		**14.93**	% Chlorophyta	**9.57**
% Chrysophyta		**50.41**	% Chrysophyta	**23.65**
% Cryptophyta		**23.46**	% Cryptophyta	**23.45**
% Euglenophyta		**10.79**	% Euglenophyta	**33.93**
% Pyrrhophyta		**0.04**	% Pyrrhophyta	**1.50**
% Other		**0.36**	% Other	**7.87**
Note: *=colony/ml/+=fil/ml				

SCRIBER LAKE PHYTOPLANKTON				
CLIENT: City of Lynnwood/Tetratech-Seattle		**SAMPLE STATUS: LUGOL'S PRESERVED**		
DATE: 10/9/2012		**NOTE: fine detrital matter**		
STATION: Scriber Lake				
Comp (Surf+2M)				
Taxon	**Cells(Col)/ml**	**u3/cell**	**µ3/ml**	**Comments**
Cyanophyta				
Aphanothece/Aphanothece spp.	100.00	3	268	cells<2um;cell sheaths obscure
+ Oscillatoriales: Pseudoanabaenaceae	1.00	924	924	thin fil<3um wide;diffuse cells;sheath not evid
Taxon Subtotal	**101**		**1,192**	
Chlorophyta				
Closteriopsis sp.	2.00	1,505	3,009	cells>200um length
Closterium sp.	44.00	751	33,063	slender lunate cell<150um
* *Coelastrum sp.*	2.00	4,187	8,373	small colony<20um
Oocystis sp.	10.00	359	3,590	
* *Scenedesmus bijuga*	10.00	256	2,564	4-cell colony
* *Scenedesmus quadricauda*	22.00	256	5,642	4-cell colony
Staurastrum sp.	88.00	3,208.97	282,389	semi-cells w/long processes
undetermined desmid	2.00	3,096.97	6,194	
nannoplankton unicell(sph)	1,500.00	382	572,265	
nannoplankton unicell(sph)	165.00	1,436	236,944	
nannoplankton unicell(sph)	5.00	11,488	57,441	cells>20um
colonial nannoplankton(sph)	80.00	113	9,043	
Taxon Subtotal	**1930**		**1,220,518**	
Chrysophyta				
Chrysophyta (non-diatoms)				
Rhizochrysis sp.	2.00	9,420	18,840	large cell
chrysophyte (unicell)	10.00	5,572	55,725	cell>20um;assoc w/detritus
chrysophyte (unicell)	6,050.00	1,055	6,382,992	cell<15um
chrysophyte (unicell)	2,420.00	268	648,431	cell<10um
colonial chrysophyte	80.00	628	50,240	
Bacillariophyceae				
Asterionella formosa	4.00	400	1,600	
Synedra sp.	1.00	370	370	
Taxon Subtotal	**8567**		**7,158,198**	
Cryptophyta				
Cryptomonas spp.	44.00	2,000	88,008	
Cryptomonas spp.	10.00	5,652	56,520	
small cryptomonads(inc. Rhodomonas sp.)	22.00	175	3,855	
cryptomonads	22.00	984	21,657	
Taxon Subtotal	**98**		**170,039**	
Euglenophyta				
Euglena sp.	1.00	10,990	10,990	
Euglena sp.	22.00	4,748	104,449	
Euglena sp.	110.00	11,304	1,243,440	
Phacus sp.	6.00	2,638	15,826	
Trachelomonas sp. (ell)	2.00	13,129	26,259	spiny cellwall
Trachelomonas sp. (sph)	32.00	3,052	97,667	
Taxon Subtotal	**173**		**1,498,630**	
Pyrrhophyta				
dinoflagellate	1.00	8,572	8,572	thecal plates obscure
dinoflagellate	1.00	21,478	21,478	thecal plates obscure
Ceratium hirundinella	1.00	60,000	60,000	
Taxon Subtotal	**3**		**90,050**	
Other				
				um3/ml
Total Number/ml		**10872**	**Total Volum**	**10,138,627**
% Cyanophyta		**0.93**	% Cyanophyta	**0.01**
% Chlorophyta		**17.75**	% Chlorophyta	**12.04**
% Chrysophyta		**78.80**	% Chrysophyta	**70.60**
% Cryptophyta		**0.90**	% Cryptophyta	**1.68**
% Euglenophyta		**1.59**	% Euglenophyta	**14.78**
% Pyrrhophyta		**0.03**	% Pyrrhophyta	**0.89**
% Other		**0.00**	% Other	**0.00**
Note: *=colony/ml/+=fil/ml				

SCRIBER LAKE PHYTOPLANKTON				
CLIENT: City of Lynnwood/Tetratech-Seattle		**SAMPLE STATUS: LUGOL'S PRESERVED**		
DATE: 11/1/2012		**NOTE: fine detrital matter**		
STATION: Scriber Lake				
Comp (Surf+2M)				
Taxon	**Cells(Col)/ml**	**u3/cell**	**µ3/ml**	**Comments**
Cyanophyta				
+ Oscillatoriales: Pseudoanabaenaceae	1.00	924	924	thin fil<3um wide;diffuse cells;sheath not evid
+ Oscillatoriales: Pseudoanabaenaceae	2.00	4,621	9,243	thin fil<3um wideX700um long;diffuse cells;sheath not evid
Taxon Subtotal	**3**		**10,167**	
Chlorophyta				
* *Oocystis sp.*	1.00	5,861	5,861	small colony>28um
nannoplankton unicell(sph)	6.00	1,436	8,616	
nannoplankton unicell(sph)	3.00	4,187	12,560	cells>20um
Taxon Subtotal	**10**		**27,037**	
Chrysophyta				
Chrysophyta (non-diatoms)				
chrysophyte (unicell)	2.00	2,026	4,053	cell>20um;assoc w/detritus
chrysophyte (unicell)	100.00	1,055	105,504	cell<15um
chrysophyte (unicell)	120.00	268	32,154	cell<10um
Bacillariophyceae				
Navicula sp.	1.00	879	879	
Navicula sp.	1.00	3,014	3,014	
pennate diatom	1.00	4,689	4,689	naviculoid cell
Taxon Subtotal	**225**		**150,293**	
Cryptophyta				
Cryptomonas spp.	4.00	2,000	8,001	
small cryptomonads(inc. Rhodomonas sp.)	10.00	175	1,752	
small cryptomonads	4.00	452	1,809	
Taxon Subtotal	**18**		**11,561**	
Euglenophyta				
Phacus sp. (large)	1.00	7,599	7,599	spirally twisted
Phacus sp.	3.00	2,638	7,913	
Trachelomonas sp. (ell)	1.00	21,436	21,436	
Trachelomonas sp. (sph)	1.00	3,052	3,052	
Taxon Subtotal	**6**		**39,999**	
Pyrrhophyta				
Other				
				um3/ml
Total Number/ml		**262**	**Total Volume**	**239,058**
% Cyanophyta		**1.15**	% Cyanophyta	**4.25**
% Chlorophyta		**3.82**	% Chlorophyta	**11.31**
% Chrysophyta		**85.88**	% Chrysophyta	**62.87**
% Cryptophyta		**6.87**	% Cryptophyta	**4.84**
% Euglenophyta		**2.29**	% Euglenophyta	**16.73**
% Pyrrhophyta		**0.00**	% Pyrrhophyta	**0.00**
% Other		**0.00**	% Other	**0.00**
Note: *=colony/ml/+=fil/ml				

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APPENDIX C: ZOOPLANKTON DATA

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SCRIBER LAKE ZOOPLANKTON								
CLIENT: City of Lynnwood/Tetratech-Seattle					***WATER Environmental Services, Inc.***			
DATE: 22 SEP 2011					**SAMPLE STATUS: EtOH preserved**			
SAMPLE: SCRIBER LAKE					**NET: 4 inch diam**			
					COMMENTS: Dinobryon/Synura/Fragil/			
					Ceratium/Oscillatoriales conspic			
ITIS Taxon	**Comments**	**Ave lngth male(mm)**	**Ave lngth fem (mm)**	**#/m3**	**Estim. Dry wt.bm ug/male**	**Estim. Dry wt.bm ug/fem**	**Tot bm(ug/m3)**	
PHYLUM ARTHROPODA								
Subphylum Crustacea								
Subclass Copepoda								
Order Calanoida								
Order Cyclopoida								
Copepodid	late instar Mesocyclops		0.9-1.05	16,049	0	4	64,198	
Mesocyclops edax	large females	0.9-1.0	1.54-1.6	20,062	4	25	164,506	
Nauplii	calanoid+cyclopoid		<.3	80,247	0	0.25	20,062	
Class Branchiopoda(cladocerans)								
Daphnia	immatures		<1.0	80,247	0	5	401,235	
Daphnia ambigua	small females w/pt helmets		1.1-1.25	24,074	0	7	168,519	
Bosmina longirostris			0.385-0.49	88,272	2.5	3	264,815	
Bosmina longirostris	immatures		0.3-0.35	72,222	0	1.5	108,333	
Class Insecta								
Order Diptera								
PHYLUM ROTIFERA								
Type 1 (mostly loricated malleates)								
Kellicottia bostoniensis			0.11(body)	104,321	0	0.01	1,043	
Type 2 (mostly illoricate virgates/incudates)								
Type 3 (mostly malleoramates)								
Undetermined Rotifers								
		Total	**Density**				**Total Dry Wt. Biomass**	
		#/m3	**#/L**				**ug/m3**	**ug/L**
		485,494	**485.49**				**1,192,710**	**1192.71**
% Calanoid Copepods		0.00					0.00	
% Cyclopoid Copepods		7.44					19.18	
% Nauplii		16.53					1.68	
% Cladocerans		54.55					79.06	
% Rotifers		21.49					0.09	
% Dipterans		0.00					0.00	
Number of species in sample		**4**						
Other invertebrates represented:								

SCRIBER LAKE ZOOPLANKTON								
CLIENT: City of Lynnwood/Tetratech-Seattle					***WATER Environmental Services, Inc.***			
DATE: 25 APR 2012					**SAMPLE STATUS: EtOH preserved**			
SAMPLE: SCRIBER LAKE					**NET: 4 inch diam**			
					COMMENTS: Synura col conspic			
ITIS Taxon	**Comments**	**Ave lngth male(mm)**	**Ave lngth fem (mm)**	**#/m3**	**Estim. Dry wt.bm ug/male**	**Estim. Dry wt.bm ug/fem**	**Tot bm(ug/m3)**	
PHYLUM ARTHROPODA								
Subphylum Crustacea								
Subclass Copepoda								
Order Calanoida								
Order Cyclopoida								
Copepodid	late instar Meso/Dia-cyclops		0.9-1.05	20,062	0	4	80,247	
Diacyclops bicuspidatus thomasi	large females	<0.9	1.25	4,012	3	7	28,086	
Mesocyclops edax	large females	0.9-1.0	1.54-1.6	12,037	4	25	300,926	
Nauplii	calanoid+cyclopoid		<.3	72,222	0	0.25	18,056	
Class Branchiopoda(cladocerans)								
Daphnia	immatures		<1.0	16,049	0	5	80,247	
Daphnia sp. (ambigua-like)	small fem w/rnd helm		1.1-1.25	40,123	0	7	280,864	
Bosmina longirostris	large females		0.56-0.63	4,012	0	4	16,049	
Bosmina longirostris	immatures		0.3-0.35	4,012	0	1.5	6,019	
Chydorus sp.			0.25-0.28	4,012	0	1	4,012	
Class Insecta								
Order Diptera								
PHYLUM ROTIFERA								
Type 1 (mostly loricated malleates)								
Kellicottia bostoniensis			0.11(body)	20,062	0	0.01	201	
Keratella cochlearis			0.17	8,025	0	0.01	80	
Keratella sp.	*K. hiemalis/quadrata grp*		0.14	4,012	0	0.04	160	
Type 2 (mostly illoricate virgates/incudates)								
Type 3 (mostly malleoramates)								
Undetermined Rotifers								
		Total	**Density**				**Total Dry Wt. Biomass**	
		#/m3	**#/L**				**ug/m3**	**ug/L**
		208,642	**208.64**				**814,948**	**814.95**
% Calanoid Copepods		0.00					0.00	
% Cyclopoid Copepods		17.31					50.22	
% Nauplii		34.62					2.22	
% Cladocerans		32.69					47.51	
% Rotifers		15.38					0.05	
% Dipterans		0.00					0.00	
Number of species in sample		**8**						
Other invertebrates represented:								